MARCH, 1941

FACTORY

MANAGEMENT and MAINTENANCE

A McGRAW-HILL PUBLICATION

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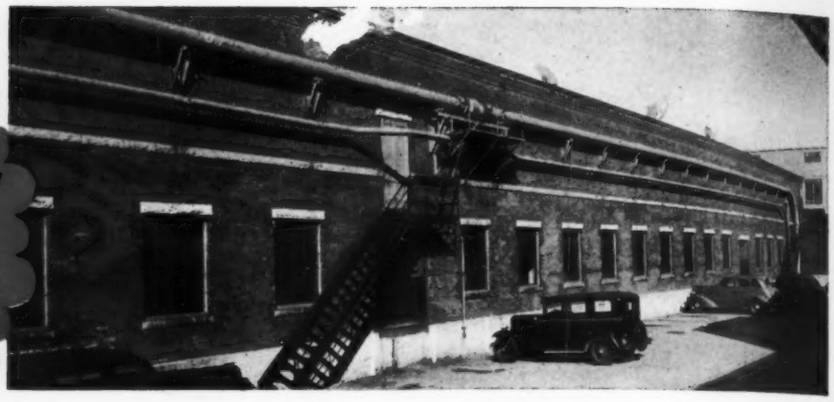
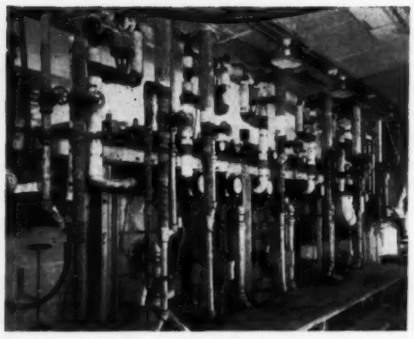
CANADA: DEMOCRACY AT WAR — Page 50

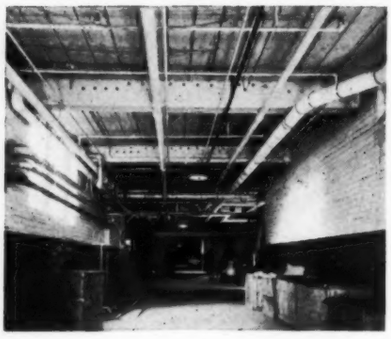
How *Cheney Brothers* Solve Maintenance Problems in 19 Individual Services



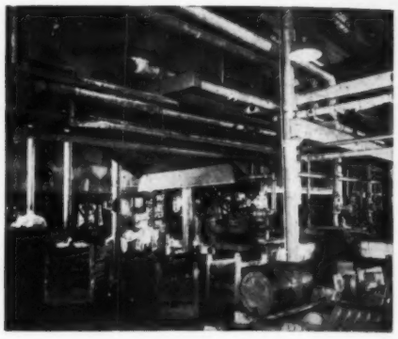
2,200′ of 3″ genuine wrought iron return pipe (400′ suspended, balance in tile conduit) are used in the 500′ run from boiler house to dye house. Installed in 1931.



This piping supplies hot water at 200°F. mixed with cold water, and steam at 125-lbs. pressure, to washing machine. Piping is all galvanized genuine wrought iron.



All these mains in velvet mill basement—steam return, well water for humidifying system and hot and cold domestic and process water—are genuine wrought iron.



Soap lines, alum solution lines, and hot and cold water lines in the dye mixing room are all galvanized wrought iron. Installed in 1921.

Genuine WROUGHT IRON

Your necktie, your wife's silk dress, your household draperies and furniture coverings, are likely to be examples of the craftsmanship of Cheney Brothers, famous silk manufacturers. Founded in 1838 and operated continuously by the same family, the organization's 103 years have provided plenty of experience data on the control of the many corrosion problems encountered in textile mills. Based on this experience, Cheney Brothers use genuine wrought iron in 19 individual services in several departments.

Some of these services are illustrated. In addition, the liquid soap lines, 125-lb. steam supply and returns, 170 degree hot water lines, and cold water lines to the dyeing machines, are all genuine wrought iron, installed in 1921. In addition to interior attack, the exterior of the piping is exposed to the fumes of all the many acids generated in the dye-house. Finally, the 20-year old heating system which supplies steam to thirty nearby residences, is genuine wrought iron.

While some of these are highly specialized services, others are found in practically every plant, and the experience of this user may suggest an economical solution for some of your own piping problems. If you have any lines where failures are occurring too frequently, or are contemplating new construction where you want to avoid future difficulties, it will pay you to find out what wrought iron can offer. All you need do is write our Engineering Service Department. For a quick picture of the many places where wrought iron is saving for users, ask for our bulletin, "Wrought Iron for Piping Systems." We will be glad to send you a complimentary copy.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

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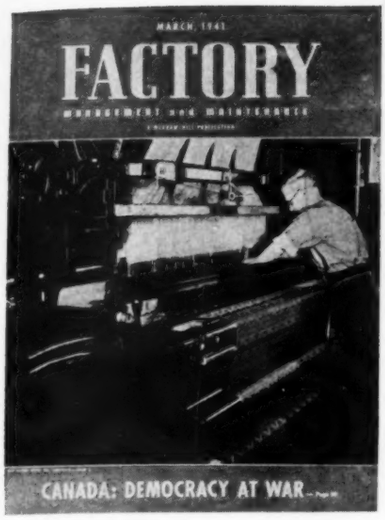
TUBULAR AND FLAT ROLLED PRODUCTS
STEEL TUBULAR PRODUCTS



On the cover, one of scores of Jacquard looms operated by Cheney Brothers, Manchester, Conn., manufacturers since 1838 of sewing silks, fine silk upholstery fabrics, women's dress goods, velvets, and men's cravat materials. The Jacquard machine, first developed in 1801, is a combination of wires, hooks, levers, and rocking arms mounted over a loom to control the movement of each warp thread before each passage of the shuttle, which interlaces warp and weft threads to form a pattern. Kodachrome by McGraw-Hill photographic department.

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FACTORY

MANAGEMENT and MAINTENANCE

MARCH, 1941

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FACTORY
MANAGEMENT and MAINTENANCE
L. C. MORROW, Editor

Industry's Twin Jobs—Do and Tell

AMERICAN INDUSTRY—and that means the responsible management of our industrial plants—has a couple of really big jobs on hand. One is to make defense equipment. The other is to tell the public it is doing so.

The battle of England more and more is being fought out in the plants of American industry. Both common sense and all the facts that have come to light support the position that England cannot win the war without tremendous support in the way of American matériel. So the first big job is to make a whale of a lot of what's needed, and then some. The purchase order is in, even if not all the blueprints have been received. This job can't be minimized, and any part of industry shirking it is entitled to no excuses.

The second job isn't so clearly docketed. Louder and louder are the calls for more production from American plants. There is emanating a kind of hysterical calling, accompanied by the claim that American industry does not realize the gravity of the situation—will come awake too late. That hysteria is seeping into the ranks of management itself, with the result that an occasional industrial executive gets up in public and says, "Men, we're loafing on our job."

Now, if industry *is* asleep, if it *is* loafing, a *lot* of industry's executives ought to find it out and get up and campaign hotly and heavily to wake industry up and put it to work. No one man can know all the facts about all of industry, but on the facts at hand I personally don't believe that the great majority of industry is either unaware of the gravity of the situation or loafing in spite of its awareness. And if *that* is so, the public ought to know about it. The only way they will ever find out is for industry to tell the story of its defense successes.

Adding together a lot of "he saids" and "he dids," as an editor is in position to do, and adding in an occasional "she said," I'm convinced that there still are a lot of brain-truster economic planners who are not asleep and who are not loafing. They are just biding their time, and would not be averse to launching something akin to nationalized industry if they could start with a public convinced that industry was not onto its job.

So this two-job situation seems to me to be pretty serious, and I hope I've made a clear case in favor of getting it handled.

L. C. Morrow

CANADA:

A LESSON TO AMERICANS in the economic meaning of war lies north of the border today. To the beat of martial drums there echoes the tread of a whole nation marching resolutely into economic uncertainty, submitting cheerfully to drastic taxation, bowing to the yoke of governmental control, subordinating everything to the building of an industrial war machine, and battling a domestic enemy — inflation — tooth and nail. To the American, Canada's example contains great significance. Ours are the thoughts and hopes of a nation striving to avoid war by building our defenses and giving aid to Britain. What thoughts and hopes are in the minds of Canadians today? In all Canada there is no one who professes to know with what sort of economy the nation will emerge from war. Again and again, words like these are heard from statesmen, business leaders, bankers, merchants, industrial management men, and wage earners:

"We don't know whether we'll come out of this with capitalism, collectivism, or what have you. We *do* know that nothing could be worse for us than a Hitler victory. And we'll do any necessary thing to help *win this war*."

Nor is there anyone in Canada who doubts that the Empire's forces will prevail.

Into the conflict Canada has poured and will pour more of its resources in men, money, machines, and matériel. Some 60,000 of its troops are overseas and thrice the number are drilling at home. The 50 new flying fields of the Royal Canadian Air Force are aswarm with daring youth determined to make good *this year* the promise of "thousands upon thousands" of fighting pilots to turn the tide for the R. A. F.

For war purposes Canada is spending $2,700,000 a day against an average $117,000 a day in the World War. Striving to avert inflation, it is levying taxes that dig deep into the people's purchasing power—at the same time nailing down incomes, prices, and profits at fixed levels.

Thirty years ago we thought of Canada as a nation of farmers, fur-trappers, and fishermen. Industrially the Canada of today bids fair to grow great in this war, although its growth is taking the shape of a practically profitless private enterprise flanked by $300,000,000 worth of semi-nationalized new plant.

Equipped only to make unfinished shells for the World War, Canada's industries are engaged today in the making of munitions of every sort. Canadian-made anti-aircraft machine guns stand guard on the rooftops of London. Canadian-built transport trucks carry Wavell's victorious troops across the African deserts. Canadian-built warships convoy millions of tons of shipping per month. Canadian-made training planes speed the Empire's pilot training plan program, and Canadian-made parachutes may at this moment be dropping British troops to earth somewhere in the world. Canadian steel mills are beginning to roll armor plate for tanks that Canada will build and "somewhere in Canada" new powder plants are making greatly needed explosives.

At what cost to the people is this being done? The average Canadian carries an income tax burden five times as heavy as that of his American neighbor—with every prospect, which he knows full well, that the load will be increased. He pays $1,875 for a car that costs the American $1,200 and $48.02 more for 10,000 miles of motoring.

THE NEW INDUSTRIAL CANADA, today, a senior partner in the Empire, aids England with men, money, and machines. (Left, a Canadian made Bren gun)

Democracy at War

On luxury goods he pays a 25 percent excise tax and on all goods an 8 percent sales tax. Finally he knows, because he has been publicly warned, that his government is determined to tax luxuries out of existence.

In every economic move it makes, the Dominion government has two main aims—to speed war production, to prevent inflation. Almost equally vital is the need for conserving foreign exchange with which to buy vitally needed war materials—steel, coal, oil, and machine tools—in the United States. All these it must purchase at a heavy loss because the Canadian dollar is worth 10 cents less than ours and Canada's balance of trade with us in most unfavorable. Despite her embargo on imports of U. S. luxury goods, however, she remains our second best world customer. At home she takes every measure to make sure that essential materials are devoted to war purposes only and that the prices of food, fuel, and consumer goods remain at reasonable levels.

As Canada plunges deeper into the business of war, the citizen faces a growing list of governmental "thou shalt nots," "musts," and "please don'ts."

John Canada is told that he cannot visit the United States, except for reasons of business or health. He has been subjected to national registration, no matter what his age, and carries a numbered identification card. He is constantly cautioned not to discuss troop or ship movements with strangers although he is not conscious of much spying. However, he has seen his neighbors of German and Italian birth put into internment camps from which some 50 percent of them have since been released.

He realizes that his news is lightly censored to prevent the publication of information giving aid or comfort to the enemy or advocating the overthrow of the government by force. On the other hand, his newspapers freely criticize the government, its actions, policies, and officials, and John Canada often applauds. Just as freely he speaks his mind wherever he may be.

A recurring criticism of the Mackenzie King government, by the way, is the assertion that it was elected on an "all out" war platform and that it isn't bearing down *half hard enough* on taxation, production, and national economic self-discipline.

If John Canada builds a house, he must build it all of wood. Steel is for war use only. So is aluminum. If he is a manufacturer of peacetime goods, from automobiles to electric toasters, he has been told that he can't put out a new model for the duration of war. He can't get new machine tools, anyway, except for war work.

As an employer, Mr. Canada can go to jail for trying to hire a skilled worker away from a war plant. As a wage earner, he can't strike on war work until a governmental mediation board has tried to keep the peace. His wages are pegged at 1926-29 levels but he gets a cost-of-living bonus if living expenses rise 5 percent in any three months.

To keep living costs down, however, the government had also pegged John Canada's rent as well as the price of butter and it stands ready to clamp down on the price of any other article or commodity that rises as a result of hoarding, speculation, or profiteering. Consequently the cost of living has risen only 7 percent in Canada since the start of the war. In these and in many other ways the Canadian economy is feeling the impact of war.

From Canada's experience we Americans may draw some hint of what may also be the policies of a nation engaged, as we are, in all-out defense. In the following pages, FACTORY *analyzes Canada's war measures—first nationally, then in terms of their meaning to the industries and individuals of a typical Canadian city. As such a city* FACTORY *has chosen Kingston, Ontario.*

CANADIAN EYES TURN more and more towards Ottawa as wartime economic controls, democratically administered and cheerfully accepted, begins to take hold

Canadian industries learn

This war will complete the industrialization, begun in 1914–18, of a once-agrarian nation. In its new role as the Empire's arsenal, Canada is making or preparing to make planes, ships, guns, shells, explosives, tanks, and all the other finished goods of war. It is spending $300,000,000 on government-financed new plant—proportionately four times our own appropriations for the same purpose.

By contrast, the Canadian industries of 1914-18 sent only shells, unfinished shells at that, and received little training in the making of other munitions. But new industries sprang up quickly in World War Canada to make consumer goods replacing those embargoed by the war. Thus by 1917-18, the Dominion's industrial capacity had tripled, attaining production levels that it did not reach again until 1929.

With a solid spread of diversified manufactures to build on, Canadian industrial production leapt forward under the new war's impetus and in 1940 eclipsed by 40 percent the peak war years, 1917-18. In its handling of production figures the Canadian government is sometimes as confusing as our own. The truth is that Canada has a real story of achievement to tell—industrial and military.

CANADA IS SENDING MEN. In the World War, 149,732 of its troops were killed or wounded. Today it already has 60,000 men overseas and its training camps at home are filled with volunteers. In addition, 30,000 men a month are taking compulsory four-month training courses.

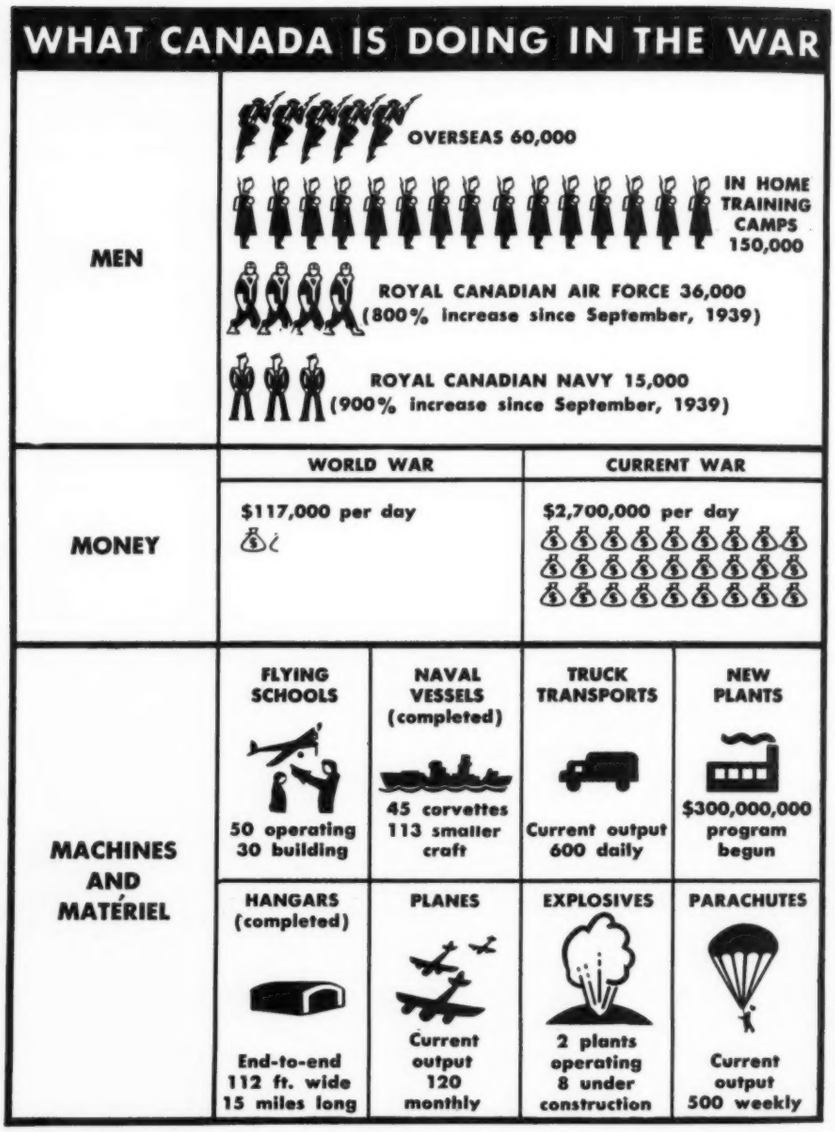
But the Empire's chief need now is not soldiers but airmen and ground crews. Canada, hub of the Empire air training program, has built 50 flying schools where 36,000 of its most promising youngsters are enrolled. The goal of 120 airfields and gunnery schools, originally set for April, 1942, may be realized this year.

Without previous aviation experience, Canada is building planes. Its estimated output of over 100 planes a month, while nearly two-thirds below its own earlier hopes, is still somewhat better, *per capita*, than ours. True, its planes are chiefly of the single-engine training type for which the need may soon diminish. True also, it has used English and American engines, in accordance with Empire policy. But it is beginning now to build complete planes, using American designs.

The story of the Dominion's production of mechanized army equipment is a real thriller which literally told itself on the hot sands of Libya not long ago. With over 40,000 vehicles already delivered and an estimated capacity of 600 a day, the Canadian motor industry excels the world in this field. And in the making of shells, 350,000 per month, Canada again helps mightily.

Interchangeability of parts greatly speeds the output of army trucks. Identical frames, wheels, springs, hubs, crankshafts, housings, and many other parts are built in the Canadian plants of the Ford and General Motors companies, These companies have also helped each other in tooling for production of 30 different types of military vehicle.

The 17,000 workers in Canada's shipyards have achieved wonders of unexpected production also. Their early completion of 45 corvettes (swift, versatile armed convoy vessels) and 13 minesweepers have meant much to the Royal Canadian Navy's proud 1940 record of 22,260,000 tons of shipping safely escorted abroad. Twenty-five more corvettes are on the ways, 14 due to be launched in May, as well as 50 minesweepers, 20 merchant vessels, and scores of torpedo speedboats and other smaller craft.



the ways of war

Canada is spending money today, as it never did before—nearly twice as much per day as it did per month in the first year of the World War. It will spend much more for, in addition to its industrial expansion, it is bearing $350,000,000 of the $600,000,000 cost of the Empire air training plan.

Withal there is criticism of the war effort in Parliament and the press. Can Canada do better? Undoubtedly it can and will. Criticism, which keeps governments on their toes, is one of the blessings of democracy. One controversy has centered around the Bren gun contracts. The John Inglis Company of Toronto, which builds the highly effective Bren machine gun, was never charged with failure to produce—quite the contrary—but it was accused in the press of making handsome profits. This occurred under contract arrangements made before the war. Recently the government, which had been under fire on the Bren issue, took over the plant and placed the management on a fee basis. The new agreement *retroactively* expunged the previous profits.

Knowing Canadians say that other plant seizures might have occurred were it not for the exceptionally generous and uncomplaining attitude of Canadian industrial management. Government contract price agreements—competitive on commercial goods, cost-plus or fixed fee on special items—offer little promise of profit and practically no protection from loss. Five percent is said to be a good net on war orders.

Yet industry is straining mightily to produce. And there are many stories of unsolicited cash contributions made to government by manufacturers and of refunds voluntarily offered on unforeseen profits. It is said that a good third of Canada's management men are World War veterans who strongly oppose profits on war.

And what of the post-war demobilization of Canada's new industrial forces? The Dominion, already eyeing the Latin-American field, will be equipped to take a major place in the post-war world market—if it can avoid inflation and compete with other nations on a stable economic basis.

ONE DAY'S OUTPUT OF ONE PLANT. Transport trucks, gun tractors, universal gun carriers, and ambulances—many destined to speed triumphant British armies across African sands—are made by the Canadian Ford, General Motors, and Chrysler plants. Interchangeable parts are a big factor in Ford and GM mass output of motor vehicles

War taxes bite deeply into

Charts by Geis

THE CANADIAN CORPORATION would fare still worse if its 1936-39 earnings were lower. Say it made money two years, lost money two years, had a 4-year average net of $10,000. Then it would pay $57,500 (75 percent) on a 1940 "excess" profit of $90,000

CONTRASTS IN TAXATION

		PERSONAL INCOME $3,200		PERSONAL INCOME $7,200	
		Jones of New York	Smith of Ontario	Black of New York	White of Ontario
CREDITS	Personal Exemption Wife and Child	$2,000	$1,500	$2,000	$1,500
CREDITS	Credit for Dependent	$400	$400	$400	$400
CREDITS	Less Earned Income Credit	$320	None	$720	None
TAXES	Normal Tax	$19.20	$111.00	$163.20	$876.00
TAXES	Surtax	None	None	$32.00	None
TAXES	Defense Tax	$1.92	$28.00	$19.52	$68.00
TAXES	State or Provincial Tax	$9.00	$9.92	$175.00	$85.68
TOTAL FEDERAL & STATE OR PROVINCIAL INCOME-DEFENSE TAXES		$30.12	$148.92	$389.72	$1,029.68

Each coin equals $10 — *Each bag equals $100*

When a Canadian tamps out his cigarette he has burned up 1.25 cents, of which 0.625 cents was a contribution to his government. The cigarette you just lit cost you 0.65 cents, probably, and returned 0.32 cents to Uncle Sam. This year the Canadian pack-a-day smoker will pay $45.62 tax on his precious vice. You'll pay $23.72.

The Canadian motorist pays $1,875, delivered, for the Buick you bought for $1,200 from your local dealer. Due to taxes and import duties, an Ontario driver gets "regular" gasoline for 29 cents an Imperial gallon (5 U. S. quarts), and so pays $1.16 for the five American gallons which, in most of our states, cost 80 cents. Ten thousand miles of motoring will thus cost the Canadian an extra $48.02.

Here is an Ontario taxpayer with wife, one child, and an income of $3,200. *He will pay well nigh $5 in direct income taxes to his dominion and provincial governments for every dollar paid by his New York neighbor to the American federal and state governments.* Seemingly more fortunate is the $7,200-a-year Canadian (a rare bird, by the way—the ratio of $5,000 or better incomes to the total population is, in Canada, 1 to 44, in the U. S., 1 to 19), for he pays but $2.50 in income taxes to the New Yorker's $1.

BUT FOR LUXURIES the Canadian pays dearly. He has to foot a manufacturer's excise tax of *25 percent* on phonographs, radios, cameras, lighting fixtures, stoves, refrigerators, vacuum cleaners, toasters, electric razors, and scores of similar items. Plus this, he pays, at the retail counter, an 8 percent standard sales tax on luxuries and necessities alike. To these he may find appended provincial and perhaps municipal taxes in varying amounts. Throughout Canada there are 50 different types of provincial taxes.

Meanwhile, the corporation for which our Canadian works is paying—assuming a capitalization of $2,000,000, an average 1936-39 net profit of $60,000 and a 1940 net of $100,000—60 percent more ($48,000 all told) than an American firm in the same boat.

If the Canadian corporation's 1936-39 average net were well below $60,000, however, far more of its 1940 earnings would be exposed to the Dominion's 75 percent excess profit tax. Say that in

Canada's income

THIS COSTS $5 A YEAR in Montreal. Financially distressed, the city has taxed automobile radiators over and above all the regular taxes on motoring. It is said that a man in Montreal with a million-dollar income would pay out the entire million and finish the year $28,000 in debt to the combined governments of Dominion, province, and city

1936 the company lost $40,000, in 1937 made $50,000, in 1938 lost $30,000, and in 1939 made $60,000. Its four-year average earnings are then $10,000. On 1940's $100,000 it pays a normal income tax of $18,000. Now on the $90,000 "excess" it pays 75 percent, or $57,500. Total tax, $85,500. There is no alternative. The company cannot, as in the U. S., base its return on capitalization instead of average income.

Yet there is little complaint. The Canadian Manufacturers Association has called the government's attention to the possibly "mischievous economic effects" of the present tax plan. Individuals are sometimes heard to hope that its inequities may be adjusted but that is all.

Canada, hard ridden by recent depressions, has long known heavy taxes on income, business, and sales. All these levies have been drastically increased by the war and the end is not yet. *The government is determined to tax luxury goods into the background of the national production picture and will boost the rates still higher if consumer demand persists.* Incidentally, the motor car industry has reduced 1941 production schedules by 20 percent.

MIDDLE BRACKET INCOMES bear the brunt of the new direct taxation for there lies virtually the only promise of larger revenues. All classes pay the 2 percent National Defense Tax—deducted from payrolls—on incomes as low as $600. Personal exemptions on regular income tax—$750 for single men, $1,500 for married men—are also low. Big incomes, sharply taxed, are uncommon in Canada. It is stated as a solemn fact that a Montreal man with a million-dollar income would pay out the whole million and finish the year $28,000 in debt to the combined governments of his Dominion, province, and city. Montreal, deep in a peculiarly horrendous fiscal mess of its own, levies special taxes on everything that breathes or moves, including its famous $5 annual assessment on automobile radiators—over and above all other motoring taxes.

A word on the Canadian consumer's psychology. He, too, does not complain. To the visitor he may appear to be making extreme sacrifices already. He is—and he is not. To begin with, the Minister of Defense, the Hon. J. L. Ralston, has stated that he would "not dishonor the word, sacrifice, by applying it to anything but the gift of life itself." To this the Minister of Finance, the Hon. J. L. Ilsley, adds: "We should regard our incomes as received in trust. We may legitimately use them for meeting our needs and those of our families, but we should not regard them as our own to spend as we choose."

Against this many a Canadian has shown a human tendency to reach out for some of the luxuries long denied him by unemployment. He is also inclined to conserve his cash, to postpone time payments until the bill collector gets after him, and to defer life insurance premiums, especially if he can keep his policy in force with a loan. Such tendencies may be ascribed to the natural attitude of a people who really do not know what is coming next in the economic picture.

Certainly there has been no grumbling, no tax evasion, no despair. In fact, many of the government's critics, in the newspapers and in Parliament, assert that war taxation has not been sufficiently drastic. The government does have, however, a clearly defined *policy* and the policy is this:

To pay for the war by taxation and by borrowing from the people, and to avoid inflation at any cost.

CANADA'S FISCAL POSITION at the start of the war was not so bad. Her national debt was about equal to her national income. Her debt, *per capita*, was slightly below ours and her national income decidedly so. The war's impetus, by the way, has given her an estimated 1940 increase in national income of 9 percent. A proportionate increase in the American national income this year would bring us to $81,000,000,000—far short of the $100,000,000,000 by which we hope to achieve the triple blessing of guns, butter, and balanced budget.

Canada's budget is *not* balanced. Initially, she borrowed $200,000,000 from the banks. The loan was chiefly expansionist in character. Next she turned to the people, offering tax exempt War Savings Certificates in denominations from $5 to $100, redeemable in seven and one-half years and paying 3 percent compound interest.

The response, however, was disappointing. The government floated a short-term bank loan and began an intensified war savings campaign in January with more satisfactory results. Industrial wage earners were urged to accept part of their wages in certificates. In most cities the big plants reported 100 percent subscriptions.

War savings are not a tax, of course, but behold how they, too, dig into purchasing power. The government, in its advertisement, suggests that those earning up to $20 a week subscribe 25 cents to a dollar a week; between $20 and $30—$1.25 to $2; between $30 and $40—$2.25 to $3.50; and over $40—$3.75 to $9.25.

AND MARK THESE WORDS—If War Savings fail, the government, still eschewing inflation, will institute *compulsory* savings. This, it is felt, will be accepted by the people as philosophically as any other necessary measure—if it is necessary at all.

So it goes with Canada and taxes. This nation, at war, cannot stop to count the cost. The government decided to nail down incomes at a certain level, and then, despite rising production, flattened them further with new taxes. Now it must perforce embark on many forms of economic control and so intrude far into the lives of its citizens to maintain the economic balance. It is of such controls that we shall speak on the next page.

Economic controls tighten

The Canadian government has marshalled a whole army of agencies, established and improvised, to speed war production and to make constant war on inflation. Step by step, the scope of governmental control has broadened over industry, labor, and the affairs of the individual. Ample authority exists in Canada's War Measures Act of 1914 for economic intervention of the most drastic sort. The compliance of business and industry has been almost uniformly voluntary and the severe penalties attending defiance have rarely been invoked. Like our own Office of Production Management, the Canadian Department of Munitions and Supply and the related war bureaus are largely staffed with outstanding management men who understand industry.

Many are the ways in which a nation's economy is hammered into fighting shape. We have seen how taxation is used in part to obviate inflationary borrowing and in part to restrict luxury purchases. Now we find three major agencies—the Foreign Exchange Control Board, the Wartime Prices and Trade Board, and the eight Controllers (or "industrial czars") of the Wartime Industries Control Board, who have taken the economic reins to expedite the war effort and avert inflation.

A third aim, tied closely to the other two, is almost equally important. That is, briefly, *to get as many U. S. dollars as possible and to keep Canadian dollars from being spent for anything in the United States except vitally needed war materials.* Canada is still our second best world customer, but she is striving now to limit her purchases to essentials—steel, coal, oil, and machine tools—which she must buy at a sacrifice because her dollar is worth 10 cents less than ours and she has a constantly disadvantageous balance of trade with us, running above $25,000,000 a month. While her export debits grow in dollars, her credits grow in pounds sterling, so she "Buys British" where possible.

Hence the Foreign Exchange Control Board order prohibiting Canadians from traveling in the U.S., except for business or health, and only then with precious little cash. This was a $95,000,000 blow to the resorts of New England, Florida, and the West Coast —for Canadian tourists spent four times as much, per capita, in the U.S. as our tourists did in Canada—but it gave Canada the full exchange benefit of the $250,000,000 tourist trade we have sent her annually.

Hence, also, the War Exchange Conservation Act ban on imports from the U.S. of luxury goods, such as automobiles, radios, cameras, electric fixtures, household appliances, and scores of similar items. (Simultaneously Canada slapped the 25 percent excise tax on her own manufacture of these goods.) Hence, also, a flat 10 percent import duty on *all* goods from nations outside the Empire.

Great influence on the domestic economy is exerted by the Wartime Prices and Trade Board, under H. B. McKinnon, and the eight Wartime Industries Controllers. Both groups are engaged in protecting the supply and holding down the prices of raw materials and commodities. The Price Board looks after such things as sugar, wool, hides and leather, rentals, butter, coal and consumer goods in all fields. The Wartime Industries Controllers preside over timber, steel, oil, power, non-ferrous metals, machine tools, motor vehicles and shipbuilding.

POWER TO FIX PRICES and to license business, declare priorities, seize industrial facilities, regulate imports and exports, and buy and sell essential commodities (through "Crown Companies" not unlike our own government corporations) is thus exercised by the Canadian government, recalling our own famed Industrial Mobilization Plan. Canada's policies are effected, however, not by executive decree but by Orders in Council, issued with the concurrence of the King's Privy Council, which is to say the Canadian Cabinet.

Bear in mind that labor prices, i.e. wages, have been effectively fixed with provision for changes consistent with changing living costs. In the first fifteen months of the war the Canadian cost of living index rose gently from 100.8 to 107.8. The Price Board has watched wholesale and retail price movements closely and has acted promptly on unjustifiable increases. For a time it took charge of bread

as Canada fights inflation

prices in certain areas where a flour processing tax of 70 cents a barrel translated itself into boost of one cent per loaf. When a temporary wool shortage impended, the Board sought out the domestic reserve stocks and forced their sale at an agreed price. The Board also buys all raw sugar entering the Dominion and parcels it out to the refineries at established prices. It has pegged butter at 35 cents wholesale and is urging conservation, contending that the average Canadian family wastes 10 pounds per month.

IN EVERY FIELD, the Price Board sees that the consumer pays no tax *upon* war taxes. It has ordered that the gross prices of goods cannot be marked up by more than the actual amount of the new import and excise taxes. It has also made it an offense to take advantage of new import restrictions—such as the recent embargo on raw silk—to increase prices. Further, the Board has licensed retail coal dealers throughout Canada, partly to break up price-fixing combinations but largely to keep close check on the national supply which is seldom more than a few weeks ahead of demand.

Probably the Price Board's most spectacular action was the pegging of rentals at the Jan. 1, 1940, level in 17 seriously overcrowded cities.

Among all the actions of the Industrial Controllers, one of the most sensational was the order of *Machine Tool Controller* Thomas Arnold, prohibiting the manufacture of new models of automobiles, radios, household appliances, or other articles in which a change of design would entail retooling. This "freezes" 1941 models for the duration of the war. Arnold also exercises absolute priorities in machine tools, issuing them only to defense plants.

Oil Controller G. R. Cottrelle has ordered that no new gasoline stations be built in Canada "for the duration," and has prohibited fuel oil burner installations consuming 4,000 Imperial gallons or more per year. He strongly urges Canadians to give up pleasure driving. He points out that only 1.4 persons ride in the average car from home to office, and suggests that neighbors get together and use one car.

Steel Controller H. D. Scully is supervising the expansion of Canadian steel rolling capacity. He exercises priorities in steel allocations. Civil use of steel has been curtailed and wooden construction substituted for everything but vital defense plants. Under Scully the number of standard shapes of structural steel have been reduced from 267 to 70, and advance buying of steel for non-war purposes has been prohibited to avoid storing of surpluses.

The big job of *Timber Controller* Loren L. Brown has been the integration of Canada's huge output with the Dominion's and—since European supplies were cut off—British needs. He encourages the use of wood in place of steel and the use of Canadian birch in place of U.S. oak. He taught the Canadian industry how to cut plywood for aircraft veneer, formerly imported from the U.S.

Power Controller J. H. Symington got the citizens of the principal cities of Quebec and Ontario up an hour early this winter by keeping daylight saving in force. This took an estimated 189,000 horsepower off the evening hour peak load, and carried the industrial provinces through the Winter without a shortage by what Mr. Symington called a pretty narrow margin. Otherwise, he would, presumably, have declared priorities. He is doing all he can to encourage industrial steam power installations. One switchover was made this year by a big non-defense manufacturing concern using 100,000 horsepower.

Almost no aluminum utensils are to be had in stores of Canada. *Non-Ferrous Metals Controller* G. C. Bateman rations aluminum to war industries only and fosters the use of substitutes in domestic products. He has banned copper exports to Japan and zinc scrap exports to all countries. "Czar" of the shipbuilding industry is Controller of *Ship Construction* David B. Carswell, who fixes fees, allocates work, determines priorities, and redistributes machines and tools as needed. Until a short time ago, the War Industries Board had only seven controllers.

Motor Vehicle Controller John H. Berry, newly appointed, has power to license any maker or seller of automobiles or parts. He can set quotas on manufacture and revise them at any time. His recent appointment suggests that the government may shortly crack down on dealers who make enticing "trades" for new car deals and that the industry's 1941 passenger car production schedule may be reduced still further this year.

Deeply as they have cut into Canada's daily life, the government's agencies possess far more power than they have so far employed. In the offing are "gasless Sundays," the compulsory restriction of passenger cars to business use, the prohibition of long-term time payment purchases, and, possibly, the "freezing" of savings accounts, to be redeemed at the nation's need in War Savings Certificates.

NO CANADIANS HERE. To conserve exchange and buy vitally needed U. S. raw materials, Canada forbids its people to travel in America for pleasure—a $95,000,000 blow to New England, Florida, and Coast resorts. Above, Miami Beach in winter

Canada's mediation law eases

Like all Canada's war measures, Dominion labor policy aims dually at increased arms production and economic stability. To reduce strikes, the Industrial Disputes Investigation Act of 1907, formerly applying only to rails, communications, and utilities, has been extended to include all industries engaged, *wholly or in part*, in war work. This Act requires that disputes be submitted to a government mediation board before a strike can be called.

To forestall inflation, wages have been pegged, meanwhile, at 1926-29 levels with a cost-of-living bonus to offset possible price changes. This, in practice, amounts to fixing of basic wage rates and puts up to the government the responsibility of keeping prices in line.

First the Industrial Disputes Act. Its application to the manufacturing industries is widening rapidly as the spread of war orders widens. Eventually it is expected to cut strikes to a minimum. It was not generally operative throughout 1940 but Canada's strike record was materially better than that of the U. S. In 1940 we experienced 2,450 strikes resulting in 6,500,000 man-days' idleness (a four-year low, by the way). Canada had but 178 strikes and 280,774 man-days idle. Allowing for the difference in the total number of wage earners, this means that the ratio of strike-caused idleness per worker was Canada 7, the U. S. 13.

There has been no talk in Canada of prohibiting strikes. The application of the 1907 Act limits them, however, by requiring that every means of mediation and conciliation be exhausted before a strike is called. While technically it provides no "cooling off" interval, it does definitely postpone strike action.

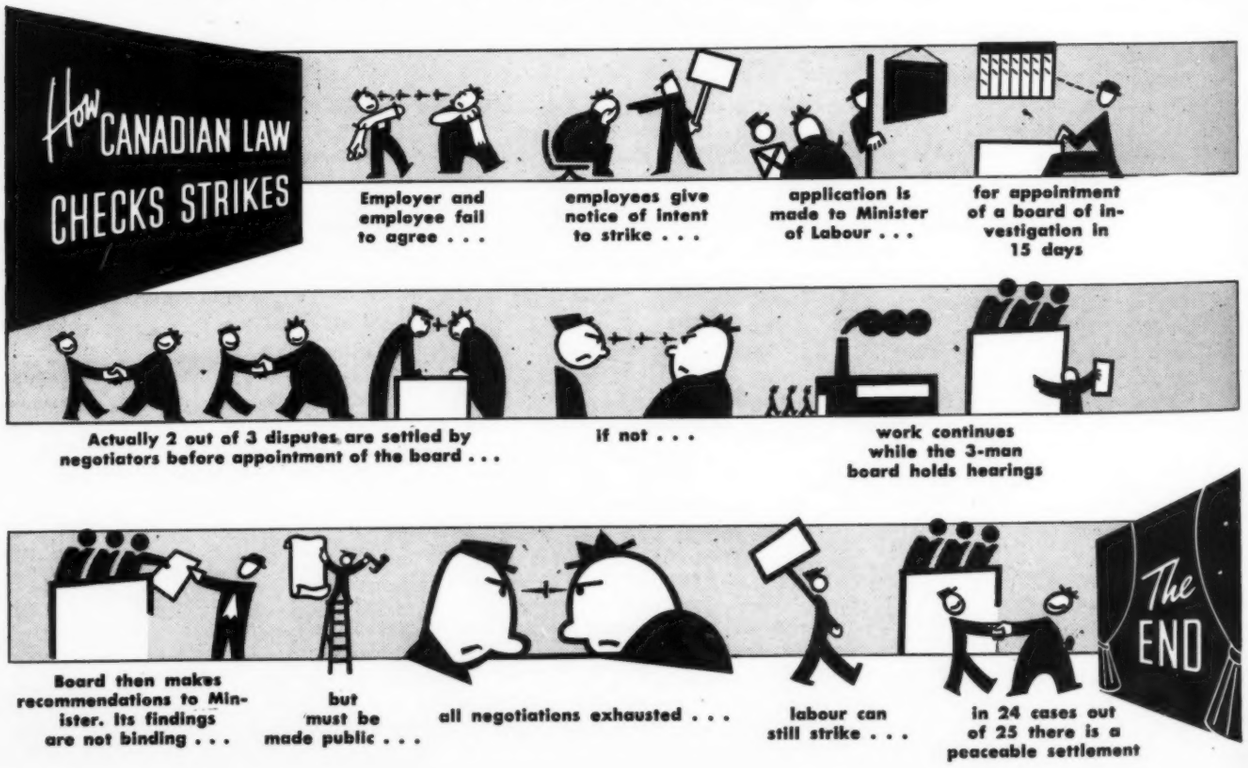
IT WORKS THIS WAY. First employer and employees negotiate. Failing to agree, the employees announce their intention of striking. Either or both parties then ask the Minister of Labour to appoint a three-man Board of Conciliation and Investigation, which he is required to do within 15 days. One member is recommended by the employees, one by the employer, and the third by the two first chosen. The third is usually a judge or lawyer.

As a matter of fact, two out of three disputes are settled by negotiation between the time of application and the actual appointment of the board. If a board *is* named it has two duties—to mediate and to gather data on which to base its own conclusions. Mediation failing, the board files a report with the Labour Minister stating "in plain terms . . . what ought or ought not to be done by the respective parties concerned."

The board's findings are not binding on either party but they must be made public in the *Labour Gazette*, organ of the Labour Department. If the employees reject the board's recommendation they are free to strike. In nearly all cases, however, both parties abide voluntarily by the board's opinion. In the first fiscal year during part of which the Act applied to war industries 52 applications were received for appointment of boards but only 15 boards were named and only two cases got to the strike stage.

Strikes have occurred in violation of the Act. In Windsor, Ontario, recently, a minority walkout occurred without notice to the Labour Department. A number of pickets were arrested and fined $20 each on loitering charges. The strike fizzled out after a time.

What has labor received in return for this wartime curtailment of its rights? A very clear statement of government labor policy has been issued, setting the wage levels of 1926-29 as a fair return for labor, affirming labor's right to organize, warning employers against "sweating" workers, and in some cases virtually instructing employers to raise wages. This statement, an Order in Council, applies only to labor in the war industries. It is not compulsory and does not require that all wages be automatically raised—or lowered—to the 1926-29 standard. But it does order that Investigation Boards make this standard the basis of their


How CANADIAN LAW CHECKS STRIKES
Employer and employee fail to agree . . .
employees give notice of intent to strike . . .
application is made to Minister of Labour . . .
for appointment of a board of investigation in 15 days
Actually 2 out of 3 disputes are settled by negotiators before appointment of the board . . .
if not . . .
work continues while the 3-man board holds hearings
Board then makes recommendations to Minister. Its findings are not binding . . .
but must be made public . . .
all negotiations exhausted . . .
labour can still strike . . .
in 24 cases out of 25 there is a peaceable settlement
The END

labor problems

findings, implying that employers paying less would find it hard to defend themselves before a board.

Labor's protection against the government's failure to fend off inflation is the cost of living bonus. This is reckoned quarterly and paid at the end of any quarter in which the cost of living index has risen by 5 percent, unless there has been a voluntary increase. If the index declines 5 points, the bonus is decreased.

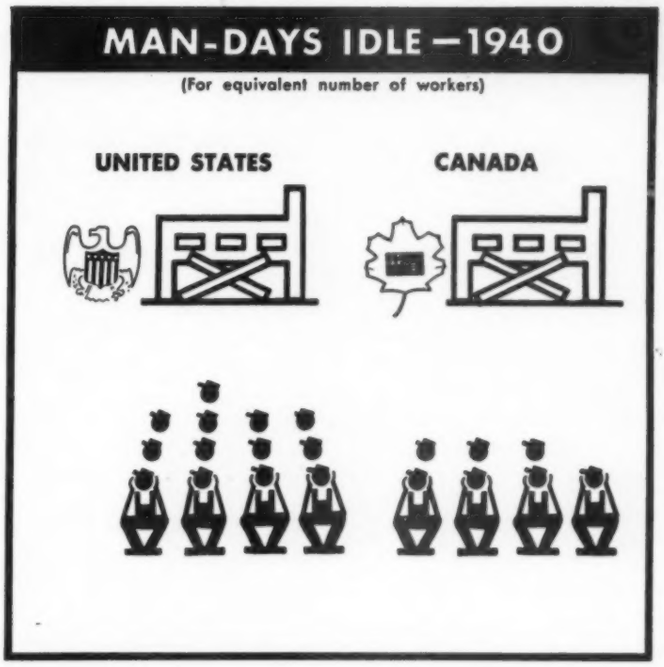
Actually the rule has scarcely been invoked. Voluntary increases of 5 to 10 percent have been quite general since the start of the war. A 5 percent boost in living costs in a single quarter would be hard to imagine in view of existing controls. And a 5 percent bonus to the Canadian worker getting 50 cents an hour for a 48-hour week would mean $1.20 a week. The measure is thus mainly significant as a *ceiling* on basic wage rates.

A WALSH-HEALEY ACT? Canada does not have one as such, but the Munitions Department imposes labor standards on contractors. For example, it sets minimum rates to be paid in aircraft factories where no union agreement exists. The rates set are about equal to union scales and perhaps a bit above the all-industry average. Canada does not have the 40-hour week but the Munitions Department insists on observance of the 48-hour maximum except in cases of emergency and then only when time-and-a-half is paid.

Does Canada have unemployment? Yes, but only about one-fourth as much, proportionately, as the United States. During June, July and August, 1940, the unemployment index fell below the 1929 average. At the turn of the year it rose seasonally as production slowed in the outdoor industries. Even then it remained at slightly more than half the pre-war figure. There has been a decided tension in the demand for skilled labor for some time although there is a large reservoir of likely industrial raw material on the nation's farms. The Dominion has under way an extensive training program to meet the estimated need for 200,000 more workers—(proportionately that would be 2,240,000 for the U. S.) by the end of this year. It is believed that only about 75,000 will need to be skilled or semi-skilled. Fifty thousand trainees are being developed in the vocational schools (many of which are running three shifts) and 50,000 more in plant schools. The armed forces are expected to take about 20,000 of the 100,000 thus trained. Recruiting, incidentally, has cut into the labor forces of many plants, non-defense companies particularly—a problem that is being met in part by the use of very young learners. Canadians can go to work at the age of 16.

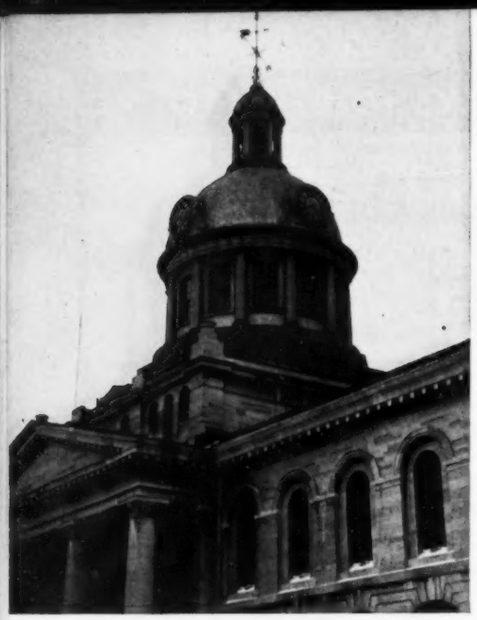
Has there been raiding among employers for skilled labor? Yes, to such a degree that it is now an offense to hire a man away from a war industry. Here is one of the most startling developments of the war. All help-wanted ads in the papers now are headed with a notice that no applications will be considered from men already working at their trades in war material production.

Just recently in Toronto, as a matter of fact, a personnel man for one munitions plant was *arrested* and arraigned on charges of enticing workers away from another.



Canada's 1940 strike record was proportionately 46 percent lower than that of the U. S.

RECRUITING CUTS LABOR FORCES. Many workers have marched off to war. In increasing numbers, employers, especially in peace time lines, are breaking in lads as learners. Canada has undertaken quick training to provide 200,000 new workers

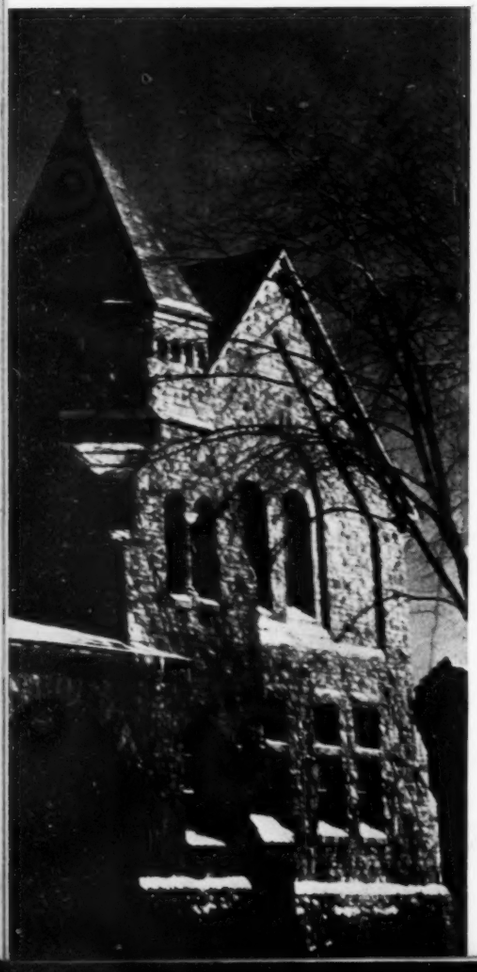


An Historic Town

The site of Fort Frontenac, Kingston was a bustling village when many of America's largest cities were stockades in the wilderness. Once the capital of Canada, its City Buildings (above) were built in 1843

A University Town

Kingston is the home of 100-year-old Queens University, noted for its engineers, with an enrollment of 2,000. Regiopolis College (300 students) was founded by the Jesuits in 1850



CANADA: Democracy at War (continued)

KINGSTON

A Close-Up of the Home Front

Meet here the people of a war-awakened Ontario city and observe their reactions as economic controls invade their private lives

WAR-CONSCIOUS KINGSTON, ONTARIO, historically a military town, teems again with men in uniform as Canada girds her forces for the new conflict. But there is a difference. Today the man with the lunch-box mingles prominently in Kingston's crowds with airmen, artillerymen, signalers, sailors, and Royal Military College cadets.

Kingston's industrial revival was on its way before the war began. Under the lash of Mars, production and plant expansion are exceeding all estimates. The Canadian Locomotive Company, already busy with war work, is adding 54,000 square feet for munitions production. The Kingston Shipbuilding Company, which since 1922 has operated solely as a drydock, now builds naval vessels.

Planned for peacetime purposes, the big new plant of the Aluminum Company of Canada is running three shifts on war work and still expanding. In Kingston's outskirts there will soon rise another large plant, that of Canadian Industries Limited, where nylon will be made. Kingston has a spread of lesser industries—leather, textiles, storage batteries, chemicals, floor tiles, food, picture frames, industrial rivets —many of which have received government orders.

Overall, Kingston's employment has more than doubled and unemployment has been wiped out in the last two years despite certain shifts in employment emphasis. The national ban on domestic use of aluminum is more than offset by the Empire's need for aluminum war goods. Canadian raw silk imports have been cut off; this will merely heighten the demand for substitutes. On the other hand the tanneries have lost much of their export market, while in textiles a drop in domestic demand, following the fulfillment of war orders, is anticipated. All employers, meanwhile, are confronted by a growing turnover of wage earners as young men flock to enlist in the armed services. Skilled labor is, of course, difficult to find.

Kingston management faces, without complaint, all the present and probable problems of war—personnel, mounting taxation, possible losses on government contracts hastily executed at experimental prices, and grave uncertainty as to Canada's post-war economic future. Kingston labor, working hard at wages only slightly increased (and far below U. S. averages) is glad to be back on the job and eager to aid the war effort. Kingston has known but one brief strike since the war

An Industrial Town

Kingston industries are building naval vessels and vital munitions. Several consumer-goods manufacturers are working on government orders. One large new plant has been opened, and another is under construction

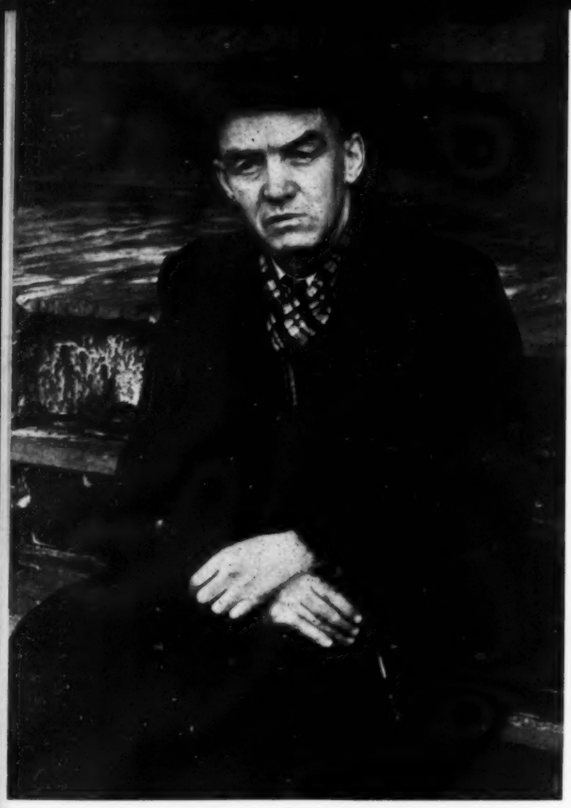
began. The city's largest plants are already 100 percent subscribed on the new War Savings Certificates.

The new industrial Kingston typifies the new industrial Canada. Kingston (est. pop. 37,000) is fortunate since its industries will have peacetime uses. The economic dislocations of war are already beginning to appear, however, and the economic controls of war are beginning to touch the daily lives of the people.

Kingstonians are typical Canadians. In the following pages, FACTORY visits, interviews, and photographs some typical Kingstonians to report their reactions as they feel the first sharp economic impact of war.

A Military Town

In or near Kingston are an artillery school, the Royal Military College (Canada's West Point), Vimy Barracks, the Dominion's largest Signal Corps station, and Norman Rogers Airdrome. To Kingston's shipyard come Canadian sailors to man newly built vessels for convoy duty at sea

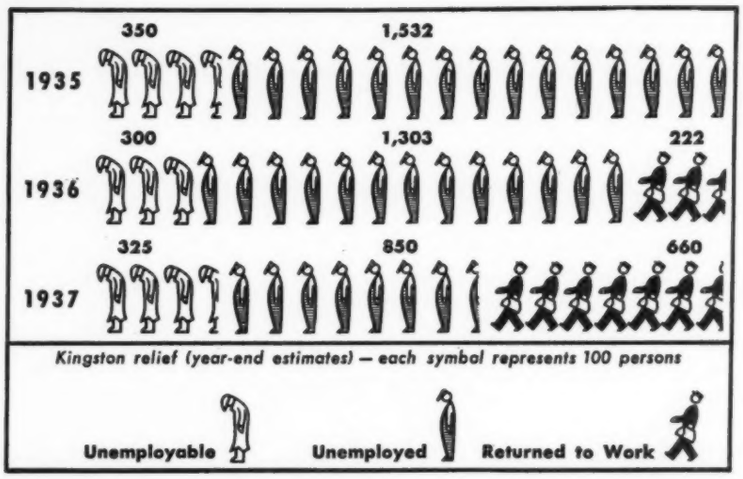


The unemployed were many in pre-war Kingston. Today, youngsters, new to industry, and oldsters, long absent, get every chance to prove their worth. Only a few months ago, young Gordon Patterson (bottom), was a grocery chain store worker. Now he is making rapid progress at the control box of an Aluminum Company strip roller. Arthur W. Bulmer (directly below) has recaptured his skill in Aluminum's toolroom, is glad to be back at the trade he learned 40 years ago. For the past 16 years he has had a comfortable job as a museum custodian, but was eager to get back to the bench and do what he could in the war effort. In all Kingston, on January 27, 1941, there were only two jobless employables. The city is in the grip of a serious housing shortage, although over 100 new homes were built last year

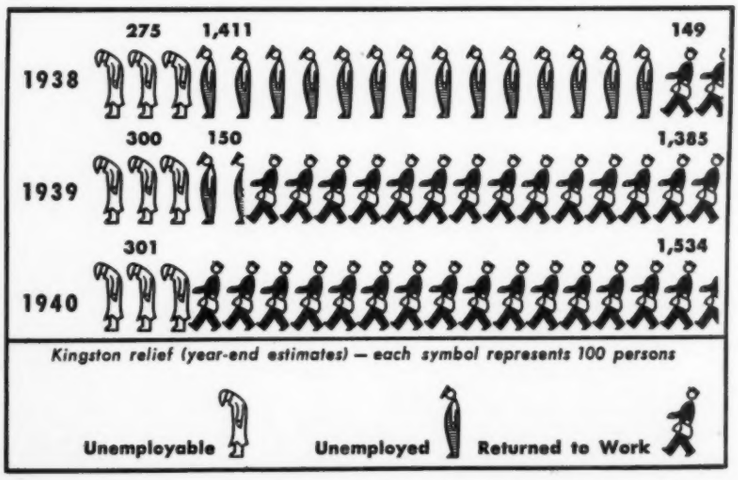
Before the war, Kingston's industries were static

There were approximately 1,250 factory workers

Unemployment was severe



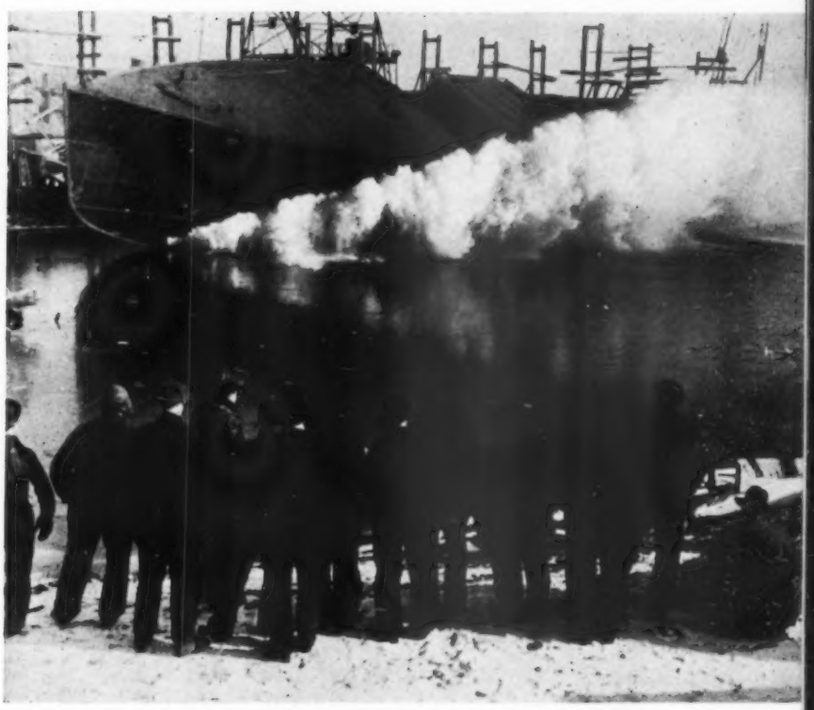
Today jobs go begging

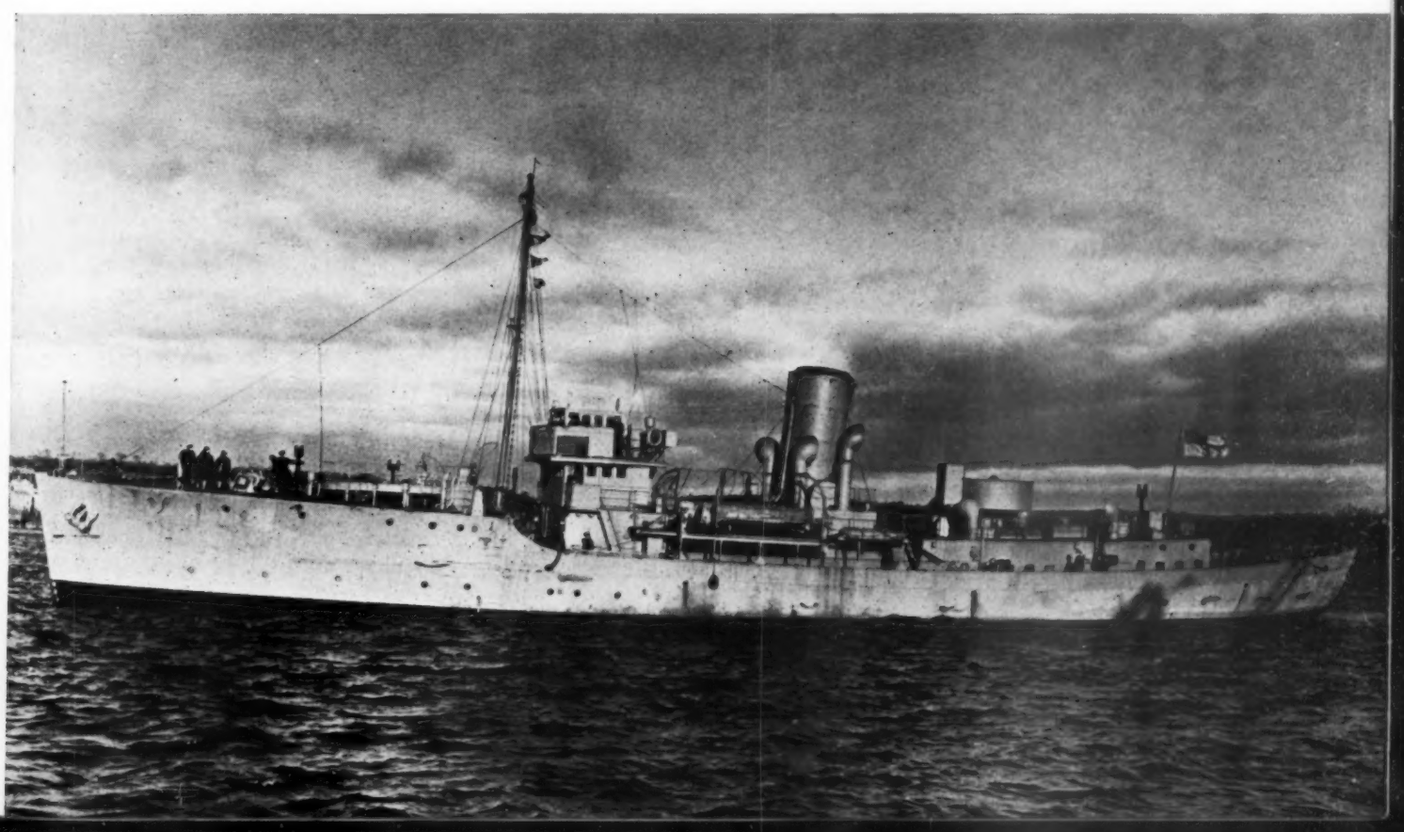


And there are 2,570 factory employees

Now plants are speeding up and expanding

Working three shifts and still increasing its capacity is the Kingston plant of the Aluminum Company of Canada (above). Adding 54,000 square feet of war production floor space is the Canadian Locomotive Company, already engaged in war work. Another of the city's older industries, the Kingston Shipbuilding Company, is building corvettes—nimble, versatile, economical little vessels, well equipped for convoy escort, minesweeping, and anti-submarine duty. At right, a new corvette hits the water at Kingston. Below, a finished corvette goes to sea. In other Kingston industries, there is a goodly spread of war orders for commercial and quartermaster items.

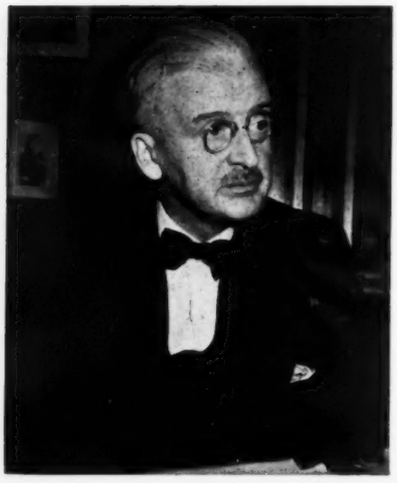




Nothing else matters— they're out to win this war

Boom town profits and "silk shirt" wages are out, a point on which all Kingston management men and wage earners, without regret, agree. Only a boost in living costs can lift wages above the basic level of 1926-29. Government buying and taxing policies promise industry little more than 5 per cent net, if any, and provide no protection from loss. Again and again in Kingston, FACTORY heard: "We don't know whether we'll make or lose money on government orders. We don't know whether we'll come out of this with collectivism, socialism, or what-have-you. We *do* know that nothing could be worse than a Hitler victory. So we're out to win this war."

J. V. McQuaid, Aluminum worker (above), signs his pledge to buy War Savings Certificates. Kingston's quota is $35,000 a month. Workers are asked to accept 5 percent of their wages in certificates. Wealthy buyers are limited to $600 worth because of the high interest return



Nobody stopped to worry about details when the Canadian Locomotive Company went into war expansion. The company may find some profit in the orders on its books, or it may not. "Like most manufacturers," says William Casey (left), vice-president and general manager, "we just saw wood and hope everything will come out all right five years from now." Canadian Locomotive is stepping rapidly into three-shift production. Already experienced in munitions work, it is trying hard to hire and train men to meet its growing needs. So far 50 of its apprentices have gone into the Ordnance or the Air Force

The Kingston Shipbuilding Company had been operating as a dry dock and had not built a ship since 1922 until, with the war, came orders for corvettes. Melville F. Thompson, general manager (above), hastened then to tool up and build an organization, recruiting formerly skilled men from hundreds of miles away. The yards were not expected to finish a ship before spring. They launched their first corvette early this winter, expect to have two more done when the ice thaws on the St. Lawrence

The lost art of calking is revived on the decks of a new corvette by George Rawley (left), 65, veteran ship's carpenter who learned his trade at 14. Working with him is Patrick Hasson, a North Irelander and World War veteran who says, "I fought the Kaiser before and I hope I'm helping to beat Hitler here now"

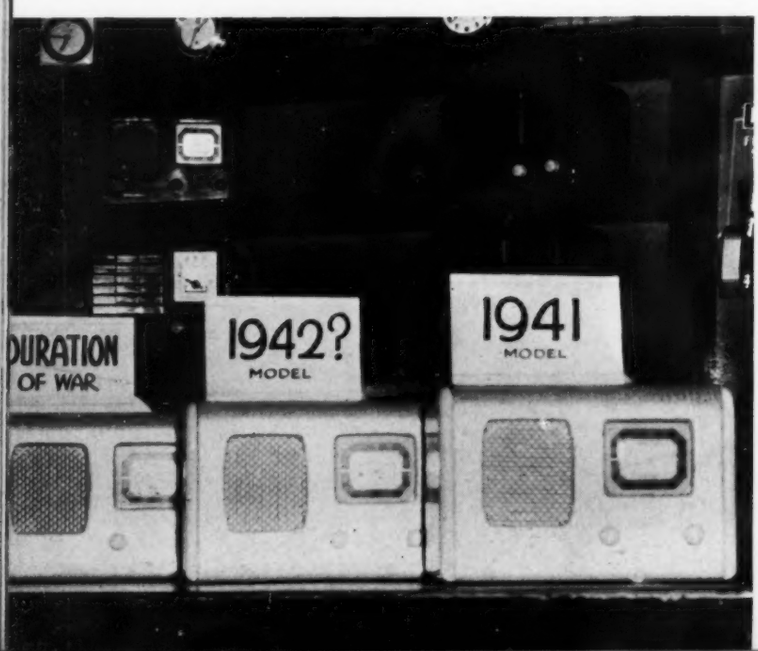
Victory is placed ahead of profits

Look at these young men—there's a story about them. They are junior executives of the Aluminum Company of Canada's Kingston plant, grouped about General Manager Neil M. Hay, (sixth from left). Of military age, many have had military training and several are qualified airplane pilots. They'd like to get into active service, in fact "they're eating their hearts out for a chance to fight," says Hay, himself a war veteran, "but they know they can do a bigger job for Canada right here in the plant. There are thousands of such men in hundreds of plants all over Canada." To Aluminum have come a university professor offering his technical services without charge and a Toronto stockbroker, happy to work in a minor job at a greater personal sacrifice than that of most "dollar-a-year" men

British-born Alfred Hodson (above) likes to think, as he works, that he may be helping to save British lives and British ships. Hodson is machining a mine-sweeper part at the Canadian Locomotive Works. Called back to his trade by the war, he had worked for many years before in a Kingston hospital. New industrial recruits (right) are coming to his aid from the Kingston Collegiate and Technical School where youngsters—many just in from the farms—are trained in night emergency war classes. Throughout the Dominion, 100,000 youths will get quick training soon. Before long the Kingston emergency classes will probably go on a three-shift basis as have those in many other Canadian cities

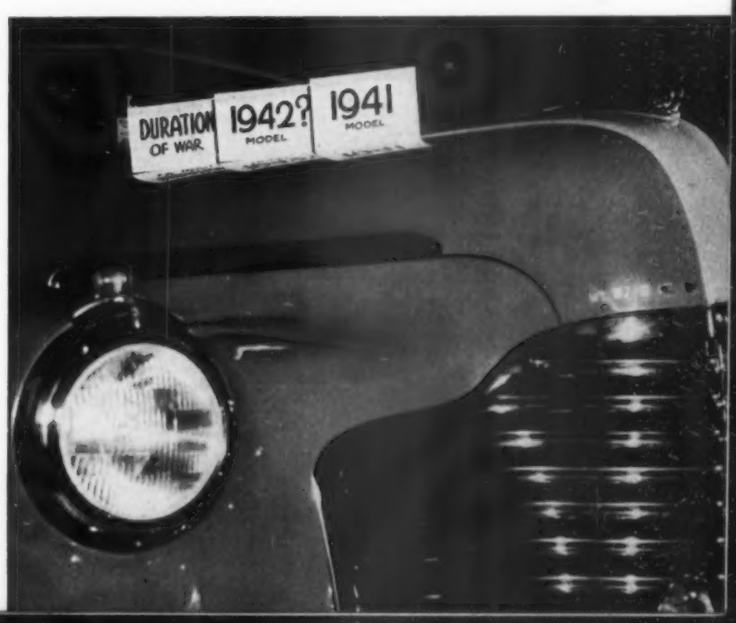
Canadian government says— No new models until the war's over

Designs have been frozen on Canadian manufactures of anything from automobiles to sewing machines in which a change of models would entail new tooling. So far that's okay with P. W. Clarkson (upper left), who reports good sales at the Kingston appliance store of Chown's Ltd. Many hundreds of Kingstonians, re-employed after long idleness, have flocked to the stores to gratify long-felt desires for luxuries. As taxes mount and purchasing power shrinks, it may be another story. Further, Kingston merchants are already aware of the possibility that steel priorities may one day stop the manufacture of such goods altogether. In any case they expect government action to curtail long-term time payment sales. . . No new gasoline stations either. For the war's duration, the erection of retail gas and oil outlets has been forbidden by Canada's gasoline "czar." The Dominion's petroleum comes largely from the United States—at the cost of precious credits. So far no "gasless Sundays" or other restrictions have been laid upon Canadian motorists. They may come soon, but rest assured, says Canada, that there will always be plenty of gasoline for American tourists. Canada also wants it understood that its gasoline does NOT cost $1 a gallon, contrary to reports said to have been spread by Nazi rumorists in the United States. The current actual price: "Regular" motor fuel, 29 cents; "Hightest," 31 cents per Imperial gallon. Five U. S. quarts make one Imperial gallon. Philosophical about it all, S. T. McCallum, Kingston filling station proprietor, goes on filling your gas tank (below). He'll accept any restrictions that come his way as necessities of war.



End of the new-car business?

What's ahead for E. Wray Van Luven (above at left), Kingston Buick dealer? Undismayed, he faces the drastic curtailment—and perhaps the eventual loss—of his new car business. No new models of passenger cars will be built in Canada "for the duration," and of course none will be imported. In fact no more commercial trucks of any model will be built after March 10—if then. Up till now Canadian truck plants, jammed with orders for war transports, have changed over for four or five days each month to commercial work. The Dominion Government is deliberately trying to tax the pleasure car business out of existence—Finance Minister J. L. Ilsley has said as much. The Buick sedan which costs you less than $1,200 in America, now retails for $1,875. . . A patriotic Canadian, Van Luven views the outlook calmly. Cutting his cloth for the future, he has reduced overhead. He now emphasizes used car sales and customer service, although he finds machanics hard to get. His new car sales are still very fair despite slow deliveries. He disapproves, however, of "wild" trading for new car deals. He recognizes that victory in the war means sacrifice of men, money, and materials, and realizes that this applies to his own business as well as any other. In complete agreement, he quotes from a statesmanlike pronouncement of the Toronto Automobile Trade Association, warning its members against inflationary sales practices, these thoughtful words: "We in Canada have not yet had it borne in upon us by danger and suffering and privation that this war is a grim and awful struggle for freedom—for our very existence—and that a big price will be exacted from each of us. We think we believe it—but we also seem to feel that we can go right on following past practice and get away with it." From any other source, this statement might impugn the patriotism of Canadian motor car dealers. Instead it speaks for a majority of the industry, strongly rebuking a minority that holds back from complete sacrifice to the war effort.



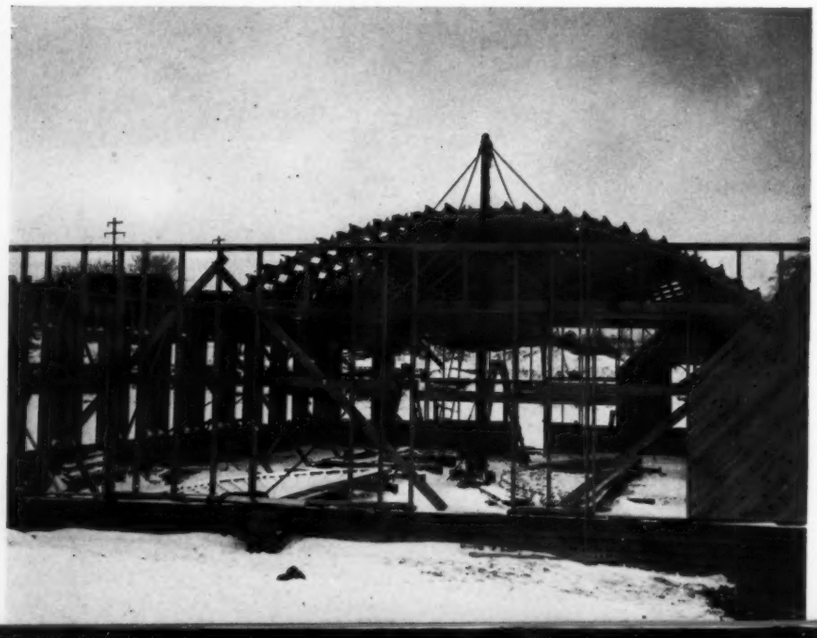
War's new economic rules

Fixed Prices

Butter cost 35 cents a pound wholesale in December, 1940, and that—by order of the Wartime Prices and Trade Board—is the most it can cost today. Consumers and merchants accept the measure gladly. Many farmers complain. They point out that basic wages have been nailed down at 1926-29 levels, whereas butter sold for 40 to 45 cents in 1929. Here Jean Moore sells a pound of pegged-price butter at Cooke's Kingston grocery store.

Licensing

J. F. Sowards, Kingston coal dealer, can lose his right to do business if he fails to report his sales regularly to the Prices and Trade Board or if he engages in price-lifting combinations. Unperturbed, he is in sympathy with the aims of the Board, knows the new measures are mainly precautionary to enable coal priorities to be set up on 24 hours' notice if necessary. Canada is never more than a few weeks ahead on coal. Its industrial provinces, Quebec and Ontario, get soft coal from the Maritime Provinces, a costly haul, and anthracite from the U. S. For his anthracite, Mr. Sowards gets $15.10 a ton.



Conservation of Steel

Canada's carpenters are learning new tricks with wood construction. There's not a scrap of steel in this addition (at the left) to a Kingston machine shop. No trolley cars have operated in Kingston for years, but the tracks remained untouched in the streets until the war. Now they are being dug up and will be used to construct a siding into the new nylon plant of Canadian Industries Ltd., now under construction.

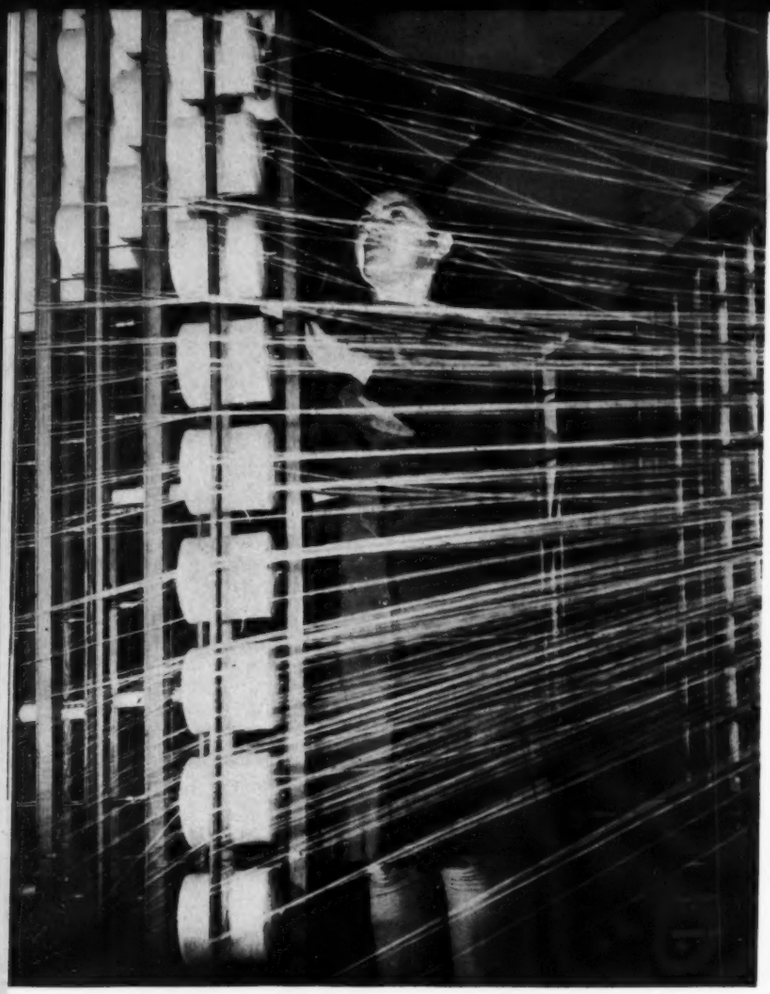
come home to Kingston

Fixed Rents

All day long from door to door tramp the newly recruited industrial workers of Canada, seeking shelter in the crowded homes of crowded factory cities. For a time rents spiraled wildly, then the Wartime Prices and Trade Board clamped down, pegged rents at the January 1, 1940 level, and set up Rentals Committees in 17 cities to adjudicate appeals. Committees include one representative of landlords, one of tenants, and a judge usually from the County Court. At first some landlords defied the new law. Now all must show cause before the committees to evict a tenant. Rental pegging, admittedly a stopgap, solves a price problem but not a housing problem. In many Kingston rooming houses, "parlors" are given over to two or three beds, and in some beds relays of roomers are even sleeping in "shifts."

Restriction of Imports

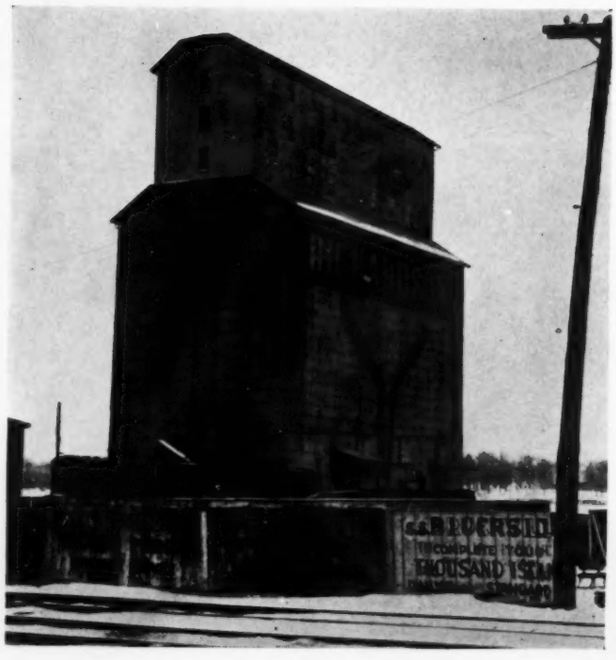
Canadian imports of silk were banned on March 1. To milady that will mean hose of rayon, cotton, or nylon. The last is displayed (right) by Marguerite Jenkins at Kingston's Stanton Store. Oddly enough, nylon will be made in the new Kingston plant of Canadian Industries Ltd. Although there may be some shortage of silk hose, prices have changed but little. War laws make it an offense to take advantage of import restrictions to increase prices. In the garment trade, experts say the new ban will make small difference since there is little silk in modern dress fabrics. What silk there is in Canada will be held by a "Crown Company" and rationed out to parachute makers.



Some war problems are still unsolved

War's inevitable economic dislocations are already apparent in Kingston. Chief of these are overcrowded housing conditions, accelerated turnover of labor, the loss by certain industries of export markets or domestic demand, and surpluses of agricultural products. The fact that Canada, still chiefly preoccupied with expanding production, has taken new steps to meet these problems, suggests that many more drastic economic decrees may yet be invoked.

Canada's textile plants are busy, but they anticipate a serious shrinkage of their domestic market when war orders are finished. For example, Hield Bros. Ltd. of Kingston, makers of high quality fabrics, now devote 40 percent of their capacity to the manufacture of unfamiliar army cloth for which they needed special machines and help. Fully occupied with domestic business at the start of the war, the company has little hope of breaking even on government contracts without large repeat orders. At left, a girl warper at work in a Hield plant



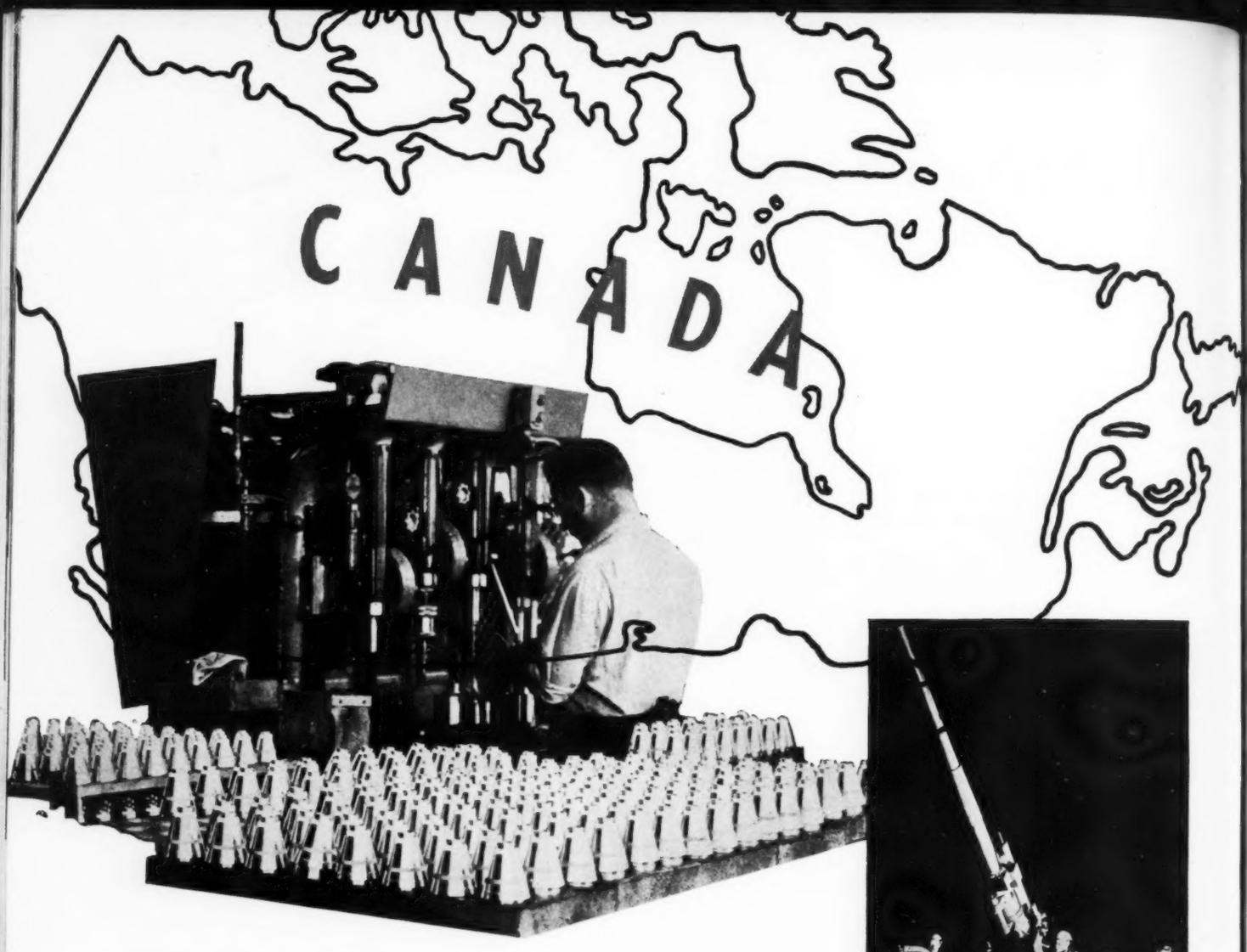
Farm surpluses, following bumper crops and loss of export markets, are a serious economic embarrassment to Canada. Kingston's two large grain elevators (one of which is shown left) are reminders of a problem that the Dominion has admittedly done little to solve. To a degree, the new industrialization of Canada is relieving the strain by drawing young men from the farms to the plants. Many employers say farm hands are better industrial raw material than youngsters from the city streets. Young farmers are held more likely to have had a smattering of mechanical experience through repairs on the family trucks, tractors, and farm implements. At the Kingston Technical School, FACTORY asked a young trainee how he happened to have left his farm home, 35 miles away. "I read about this opportunity in *The Kingston Whig-Standard*," he replied

An answer to the farm problem is provided by Arthur Davies, managing director of the *Whig-Standard*. His paper, like many others in Canada, points out that Great Britain could absorb the Canadian surpluses of butter, cheese, and other products if it could pay prices equal to the Canadian cost of production. He urges that the Dominion government subsidize Canadian farmers for the difference, the subsidy to be raised by a general tax. He argues that no occupational group should bear such a burden alone and considers the subsidy tax one of many sacrifices that Canadians have yet to make in the war

A note on turnover—it is deeply aggravated by war. Even munitions plants lose many trained men to the armed services. Consumer-goods producers, although they may have war orders, face a very serious training problem. Curiously, those employing many women suffer just as much. Girls whose husbands have joined the army are quitting work in large numbers to go home and live with parents or in-laws for the duration of the war.

A possible answer to one phase of Canada's industrial housing problem is the plant dormitory. Construction workers at the Aluminum Company's Kingston plant enjoy warm, clean quarters with private rooms (right, above) and eat the best of fare in the messhall operated by a Toronto caterer. When the construction job is done, these men will move on. Then, probably, the company will house here some of its own young and single industrial recruits. Other Canadian firms are thinking of following suit. Since the Dominion government has not as yet evolved a housing program, this sort of social thinking by management may do much to relieve crowded conditions in the cities and obviate the economic evils of overbuilding

Confident of Kingston's industrial future, in war or peace, is J. M. Hughes (left), Secretary of the Kingston Chamber of Commerce. He points out that the city's plant expansions were mainly planned for peace purposes. He believes that post-war Canada will take its place among the industrial nations of the earth and is hopeful that the war effort can be achieved without inflation



YOU HAVE VISITED CANADA. With FACTORY staff writers and photographers, you have studied the actions of the Canadian government and the reactions of the people in today's total war. Naturally you are comparing Canada's situation with our own.

It is important, as you draw your conclusions, to remember two outstanding contrasts. Canada is at war—we are not. The British Empire needs every scrap of war material that Canada can produce; if every factory in Canada could be turned to war use, it would be. But our own industrial machine is so tremendous that it does not need to be developed solely to defense production.

Here is one evident parallel, however, that raises a question of the utmost import to Americans. *How far will we be willing to go to put defense on a pay-as-you-go basis and to fight inflation?* This is a problem we shall have to face. Canada shows us that it cannot be solved without great determination and economic self-discipline.

This also we learn from Canada: Democracy can use the weapons of autocracy *against* autocracy. Democracy can be strong. And it can do a better job of economic mobilization than can dictatorship because the job is a cooperative, voluntary one. It is heartening to report that, while Canadians have embraced every necessary form of economic control, they are not in the least afraid that they have surrendered their fundamental right to govern themselves.

In these pages, FACTORY has told Canada's story, therefore, with the hope that it will help Americans better to understand the meaning of democracy at war.

Will NLRB Say "Discrimination!"?

Here are ten tests applied by the Labor Board. Use them to check labor policies and so avoid having charges of discrimination brought by employees against your company

ROBERT SALTONSTALL

Personnel Director, Arlington Mills
Lawrence, Mass.

CONGRESS PASSED the National Labor Relations Act in July, 1935, for the purpose of eliminating certain substantial obstructions to the free flow of commerce by encouraging the practice of collective bargaining and protecting the legal right of workers to organize into unions. It provided in Section 8 (3) of the Act that "it shall be an unfair labor practice for an employer, by discrimination in regard to hire or tenure of employment, or any term or condition of employment to encourage or discourage membership in any labor organization."

Many of the controversies between labor and management arise under Section 8 (3) where the employee or his representative complains to the Labor Board that the employer has discriminated against him because of his union affiliation or activities. Of the 4,618 unfair labor practice cases filed with the board during the last fiscal year, 62 percent, or 2,863 cases, involved the charge of discrimination either for union activity, for testifying in a hearing before the board, or for filing charges with the board.

From the many decisions and interpretations of the board it is now possible to glean certain well-established precedents and principles upon which its final decisions are based. A most valuable source of reference is the board's annual report which devotes a special section to "principles established." A review of recent cases shows us the board's procedure in handling charges of discrimination, its method of approach to the solution of such cases, and indicates the criteria or tests which it applies to the facts in reaching decisions.

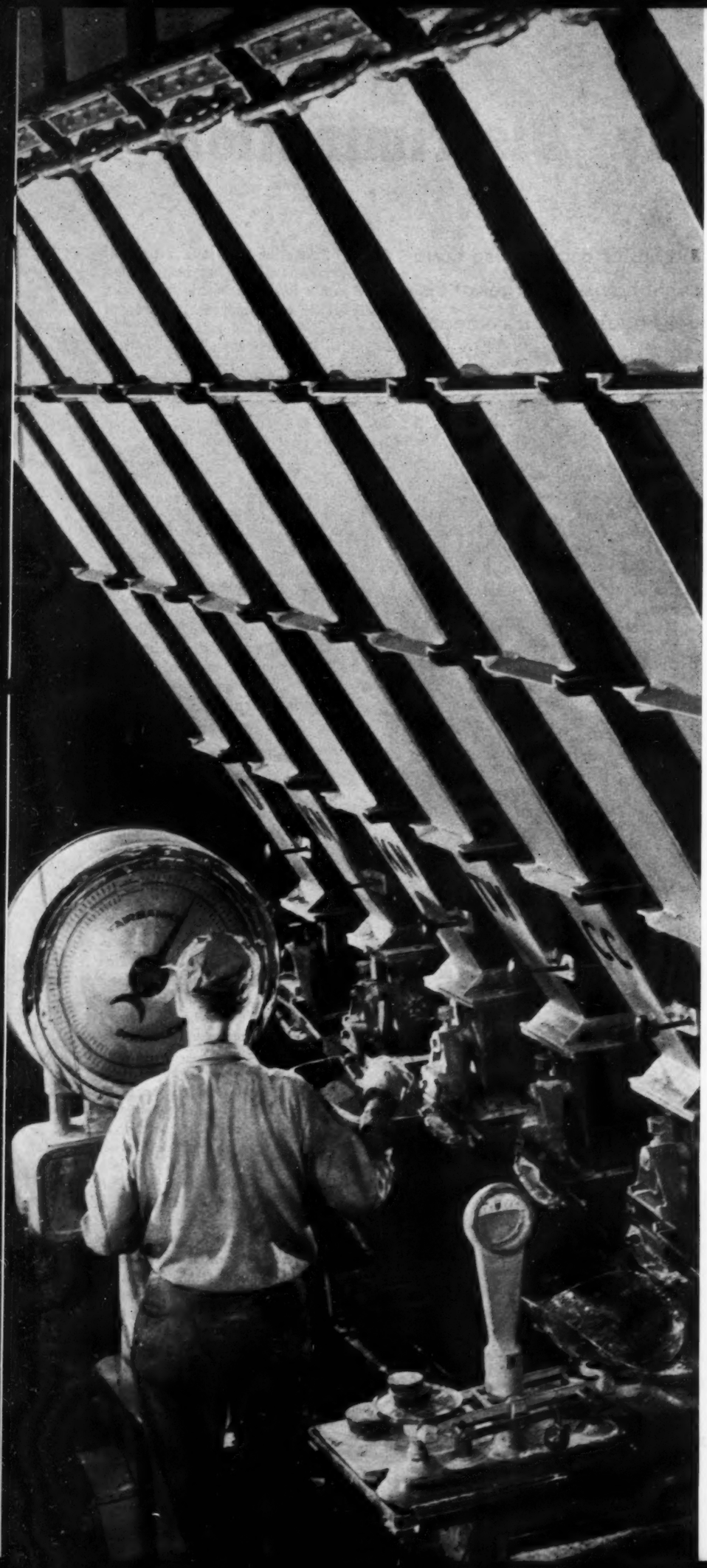
We have come to realize that the board frequently finds it necessary to go beyond the facts—that is, it infers from the evidence presented by both sides what have been the employer's true motives for the action taken in dealing with his employees. Since the interpretation of evidence rests with the board, which employers commonly consider to be biased in favor of labor, it is not surprising that we are unable to understand or accept the decisions of this highly specialized administrative agency.

At present there is ample material available to employers in the form of detailed and summary reports of labor cases decided by the board and the courts. On the other hand there is a dearth of material on specific aspects of these decisions which has been boiled down into a form that would serve as a ready guide to employers. Boards of directors, top management, operating executives, department heads, employment managers, and foremen need certain fundamental information for the formation of policies and procedures, and for the proper conduct of their labor relations activities both in the plant and outside. The increased emphasis upon supervisory training arising with the program for national defense requires that such technical information be presented in simple, understandable form in conferences and in supervisors' manuals.

This article proposes to answer the need for a practical guide that will help the employer avoid having a charge of discrimination brought against him by one or more of his employees. It will summarize the most

(*Continued on page 170*)

Robert Saltonstall went to work for Pacific Mills in June, 1939. Did industrial engineering, production analysis, and time-study work for six months. Switched to the sanitation squad in the company's Print Works and worked as an unskilled laborer from November through April of 1940. Was then appointed staff assistant to the manufacturing agent, stepped into his present job two days before Christmas, has been spending most of his time thus far administering a new group accident and health insurance plan. Pacific Mills has 6,000 employees, makes worsted cloth, and does commission combing and wool top manufacturing. Saltonstall got his A.B. at Harvard (1933), where he played hockey, rowed on the crew, was president of the student council and first marshal of his class in his senior year. After four years in a Boston bank he went back to school, got his M.B.A. at Stanford. When he isn't trying to keep up with the rapidly growing body of current literature in his chosen field, Saltonstall relaxes on the nearest squash racquets court, ski trail, golf course, or tennis court. That apparently leaves him just enough time to attend to his vegetable garden, with a couple of minutes now and then in his cellar workshop. This is his first FACTORY article



Wiped Out

STOP HERE if you're expecting to read about "miles" of conveyors. Read on if you want to know how one company —ours—eliminated a serious bottleneck, increased production substantially, and greatly improved the quality of its products.

This *is*, to be sure, a story of conveyors, but their length is measured in simple, understandable feet, and a very few feet at that. The conveyors are in a new warehouse and primary department building. And they serve not only the original battery of mixing machines already in operation but also a new Banbury-type installation.

Transmission and conveyor belts, industrial hose, and packing are not usually thought of as defense matériel. But the plants that make the materials of modern warfare and defense must have such belts, plenty of them, and must have them this week, now, not next month. Add all the lengths of hose, all the pounds of packing these same plants need. Add, incidentally, the 450 miles of firehose Hewitt shipped to Britain in 1940. The sum is increased output.

More Mixing Capacity

Now increased output may mean, for you, more machines in a pressroom, more people in a critical subassembly or final assembly department. For us it meant more capacity at the beginning of our manufacturing operation—more capacity back in our mixing department. There was *our* bottleneck.

Obviously, the new Banbury mixer would give us the added capacity so badly needed. Equally obviously, a machine that handles batches up to 500 pounds and does a thorough mixing job in 8 to 12 minutes, depending on

An 84-in. Banbury mixer that can handle batches up to 500 pounds and mix them thoroughly in 8 to 12 minutes, takes a lot of stoking. Batches headed for it and the other mixing machines are made up in line-assembly fashion. This is a two-man job. One weighs out the right number of pounds of rubber. The other runs the batch car along under the bins, weighing out the exact amount of each material as he moves down the line. On the back end of the batch car is a far more sensitive scale for materials used in small amounts. Result has been not only more output but also better quality

a Bottleneck to Get More Output

Take a new 84-in. Banbury mixer, put up a raw materials warehouse close by, install the latest kind of storage bins, a batch car with scales, a few feet of conveyor, an automatic elevator—and you have Hewitt's recipe for bigger output, better quality

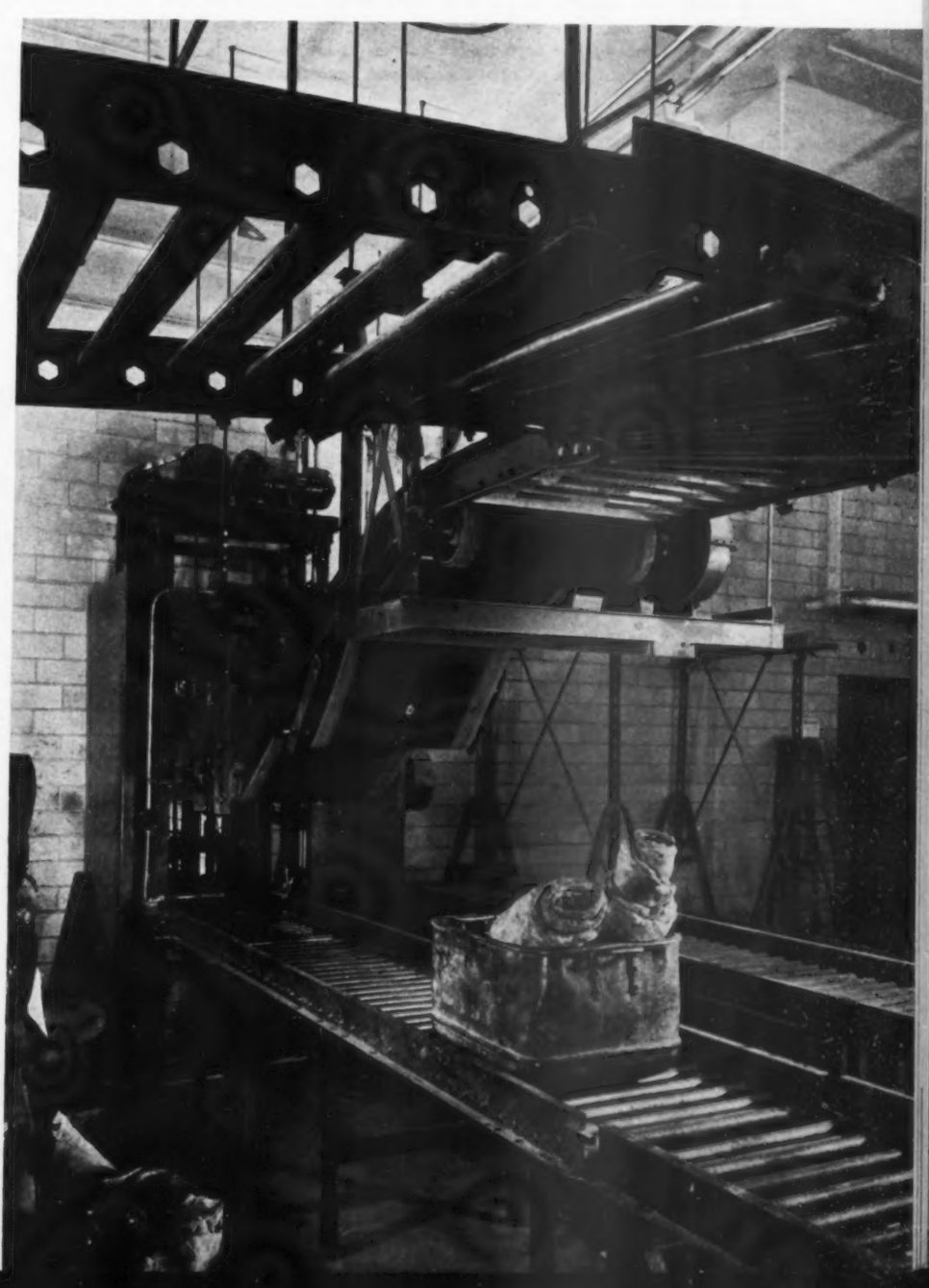
JAMES MARTIN
Factory Manager
Hewitt Rubber Corporation
Buffalo

what's in the batch, was going to take a lot of steady stoking to get the production we had to get out of it. This all pointed plainly to the need for better storage and batch-preparation facilities—and just as plainly to the necessity for getting the batches promptly and regularly to the mixers, especially the Banbury.

The new warehouse is a handsome 3-story building faced with red brick, its south walls separating it from the mixing department. Bands of glass brick on the north and west walls provide glareless natural illumination by directing the north light down and the west light up. Bands of pivoted steel sash on the east wall complete the pleasing horizontal effect; these windows may be opened to supply needed ventilation. Actually, little is needed. There is no dust on the first floor or on the second where batches are weighed out. There *is* a small amount on the third floor where powdered materials are dumped into bins—but only a small amount and only at the mouth of the bins—and only for the brief moment that it takes to empty a bag. The man on this job wears a respirator when dumping dusty materials.

Along the west side of the building runs a freight-car dock. Most of the raw materials come in by car, often on pallets. There is also an unloading dock on the east side to take care of the small amount that is trucked in.

Pallet materials are stored mainly on the second and third floors, and are handled by a combination conveyor and lift-truck system. All liquids and powdered materials are stored on the third floor, readily available for loading into the dispensing bins or tanks. Also on the third floor is a specially designed storage unit for handling the various oils and heavy viscous liquids used in rubber compounds. Full 50-gal. drums are hoisted into position and allowed to drain into 110-gal. tanks. Six of these storage tanks are steam-heated and a sheet-metal hood with steam pipes along one side encloses drums and tanks to speed the flow of heavy liquids. Heavily insulated pipes carry the oils to outlets on the second



Batches are weighed out in cans, and the cans are moved to the mixing machines by gravity roller conveyor. Mixing is done on two levels. A batch intended for the upper level—i.e., the big Banbury—passes straight through the elevator shown at rear of the photograph. But if the batch is headed for the lower level, it stops on the elevator, is carried down to the lower level, then moved off on another roller conveyor. The elevator is push-button controlled from the end of the batch-preparation line. Electric eyes stop elevator from moving either up or down until it has been properly loaded

In the foreground, empties on the way back to the point where the batches are made up. Cans from the second level move through the elevator; those from the lower mixing floor come up by elevator just as they went down when loaded. Cans are then lifted by a belt conveyor to a point high enough to enable them to move the rest of the way by gravity. Batch-assembly floor is also used for storage. Note bags of raw material and bundles of rubber under conveyor. Right, batch car and conveyor leading to elevator

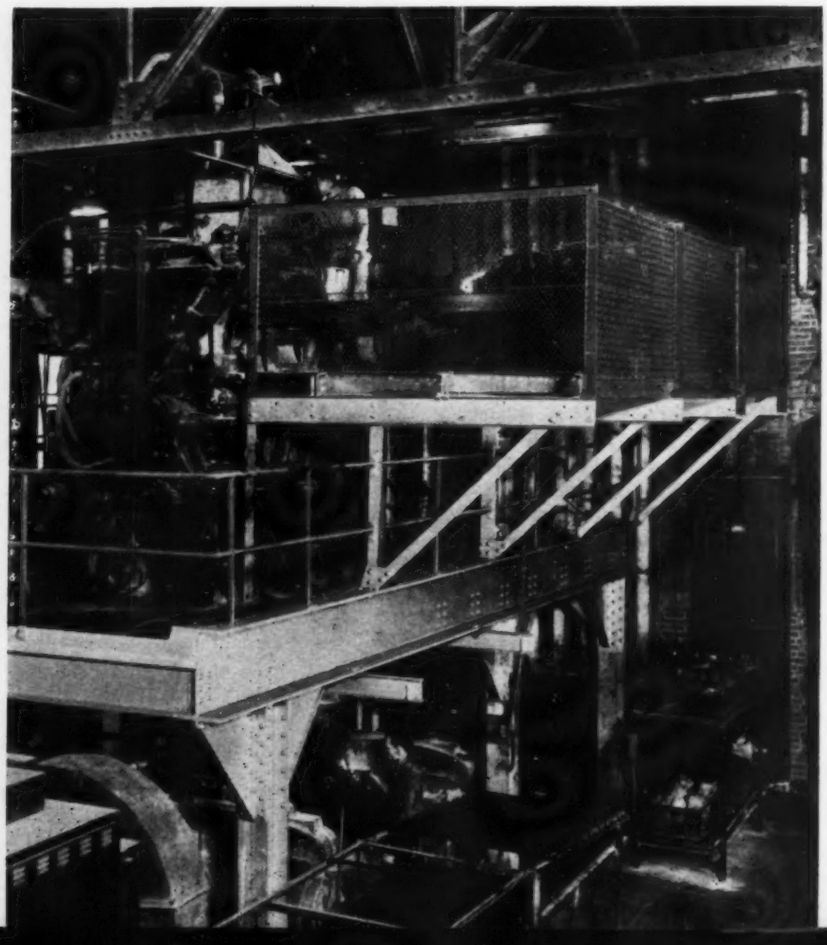
and ground floors convenient to the mixing machines.

One man takes care of this liquid-storage unit somewhat incidentally as part of his regular job of emptying powdered materials into the bins that serve the batch-preparation department on the floor below. There are fifteen large bins in a single unit for the materials that are used in large quantities, and fourteen small bins with openings flush with the floor for the materials used in small amounts. High separators, as shown in one of the photographs, prevent accidental spilling as the large bins are reloaded.

Making Up the Batches

Directly below are the two men who make up the batches. Here come the conveyors in case you are beginning to wonder where they enter the picture. But first the batches. One man weighs out the right number of pounds of rubber into a metal container or "can." The other runs a scale trolley under the various bins. The bins, by the way, are equipped with air agitators and brush-type dispensing gates which make it possible to cut the flow of batch material down to a minute trickle.

Batches are made up in assembly-line fashion, with a can mounted on a sensitive calculating scale. As the scale trolley moves under the bins, the prescribed amount of each material is added to the batch until, as the weighing unit reaches the end of the line, the batch is completely assembled and ready for the mixing machines. For



Cans headed for the big Banbury mixer move straight through the automatic elevator, are here loaded into the machine by the worker on the upper level. A hood over the mixing chamber removes any dust that may possibly be raised in the dumping process. At the first-floor level is seen the delivery end of a short section of double-decked roller conveyor which takes cans away from elevator. Empties are placed on the top track of this conveyor, slid back into the elevator, then lifted to a point well above the second floor, whence they roll to point of use

some compounds extremely small amounts of certain materials are used and must be weighed out on still more sensitive scales also mounted on the weighing unit.

Ready now for the conveyors. The batch is complete. The weighing unit has reached the end of the assembly line. The cans—there are anywhere from two to six in a batch—are slid off to a section of roller conveyor and move by gravity to or through an electric elevator.

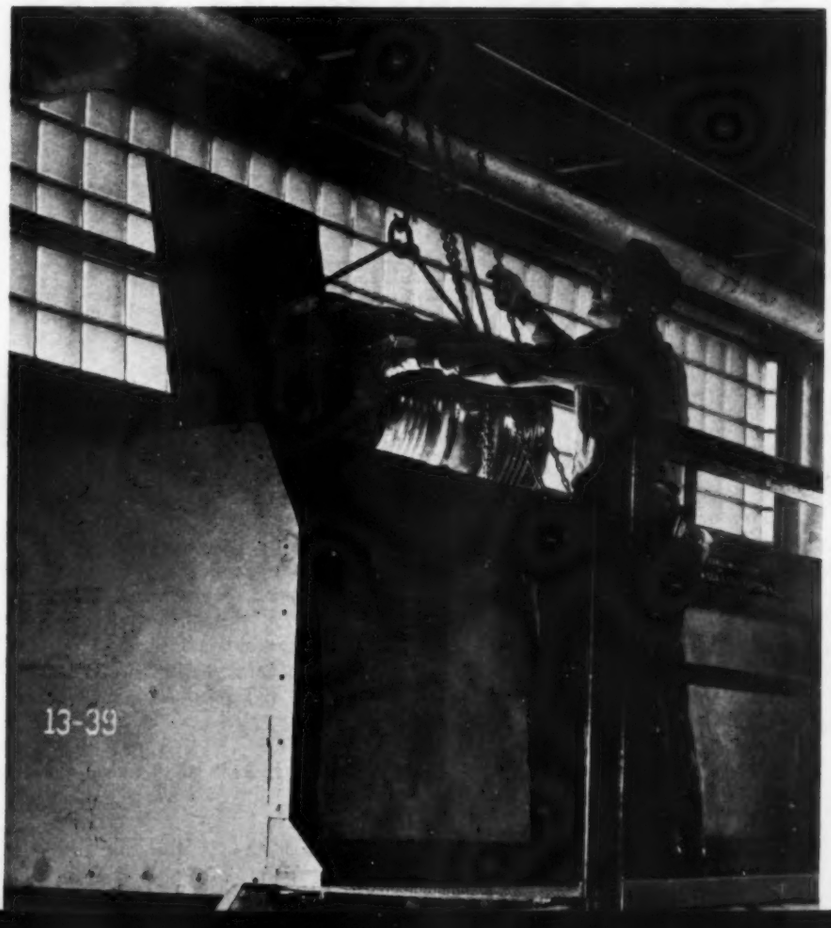
Just Pushes a Button

Mixing is done on two levels. Cans move right on through if destined for the new Banbury machine whose mixing chamber is on the upper level. The operator simply presses a button (he is actually doing this in the photograph on page 76 which automatically lowers a stop on the elevator and lets the can pass to its destination.

If the can is scheduled for the first floor, the stop on the elevator stops it and the operator pushes another button which starts the elevator and moves the can to the lower level. As it lands it depresses a pin mounted in the floor. This pin raises a weight on the can stop, lowers the stop, and that lets the can roll out of the elevator on the lower section of a double-decked roller conveyor.

Empty cans from the first floor are placed on the upper deck of this conveyor, and when the elevator car comes into position a pin on the side of the car lowers the can stop which lets the empty roll into the top deck of the elevator where it bumps into another stop. As the elevator rises again to the second floor, another pin on the opposite side of the shaft lowers the can stop and lets the can roll out to a belt conveyor which carries it up high enough to move back on gravity rollers to the beginning of the batch-preparation job. Also, when the elevator arrives at the second-floor level, a pin on the elevator car actuates a lever on the shaft, and this lever in turn lowers the can stop on the upper conveyor and permits empties from the second-floor mixing machines to roll through the elevator onto the belt conveyor. Electric eyes on both upper and lower levels prevent any possibility of the elevator's moving while the can is half on and half off.

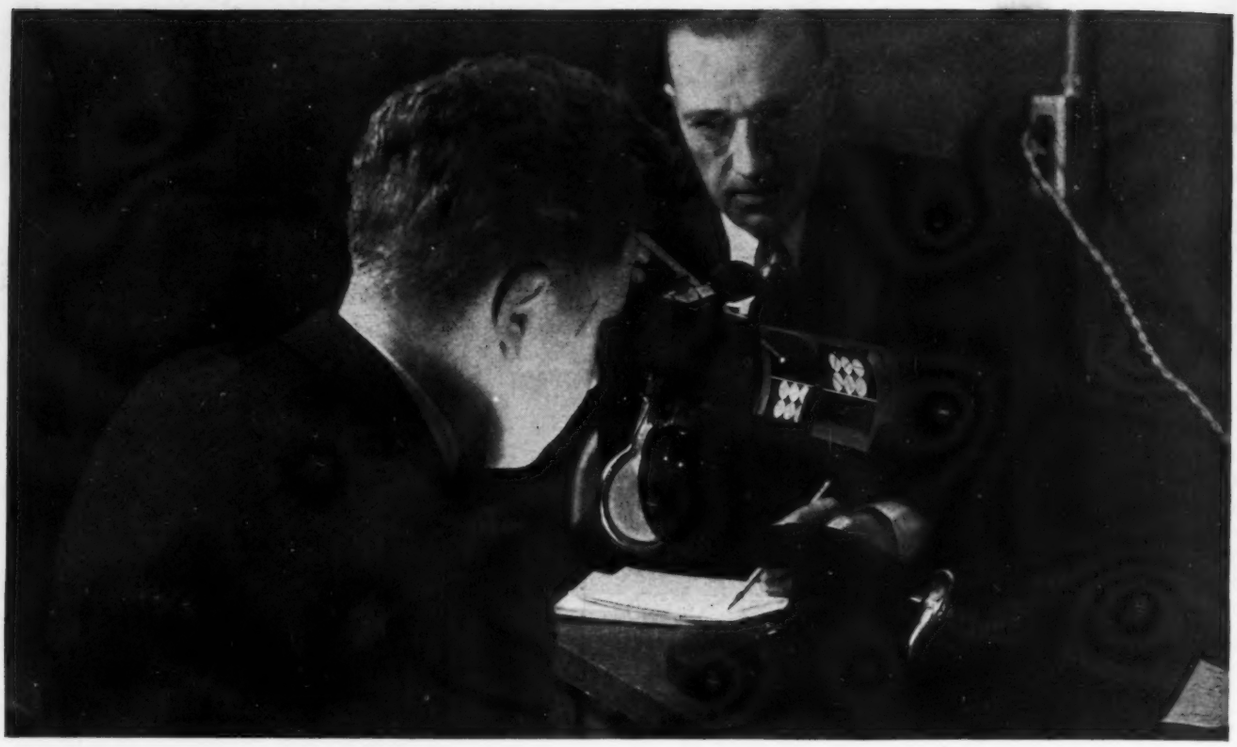
On the third floor, directly over the batch-assembly department, this lone employee keeps bins filled. Separators make spilling impossible. Operator wears a respirator when he handles dusty materials. There are fifteen large bins in this unit, fourteen small ones in another. Man also has time to attend the oil storage unit pictured below



Better Belts and Hose

Which is the story, as I see it. The bottleneck is gone. Output is greatly increased. And the new method of making up the batches permits far greater accuracy in weighing out ingredients than was possible before. The end result is not only more, but also better, belts and hose.

Specially designed storage unit solves the problem of handling oils and heavy viscous liquids used in rubber compounding. Full 50-gal. drums are hoisted into position on racks and allowed to drain into 110-gal tanks. Six of the tanks are heated by steam; a sheet-metal hood encloses both tanks and drums to retain heat and speed the flow of thick liquids into the heavily insulated pipes that transport these materials from the third floor to outlets on the second and ground floors convenient to the mixing machines



Applicant takes telebinocular test in Work Sampling Division of Ohio Employment Center, Cleveland. Instrument measures visual ability with respect to depth perception, acuity, color discrimination. Astigmatism is discovered and measured. Eye tests are important in gaging the ability of the applicant for precision work, and for recognizing safety and danger signals. The aptitude tests shown here, although photographed in Cleveland, are similar to tests given in Toledo and herein mentioned by the author

State Helps Find the Men to Hire

When DeVilbiss has jobs to fill, it goes first to Ohio's employment service, which not only turns up the men but also tests them. Have you tried your own state's service?

A. C. KURTZ
Personnel Manager
The DeVilbiss Company, Toledo

SUPPOSE YOU WANTED, in short order, an air conditioning engineer of experience, a chemical engineer with paint experience, a special machine assembler. Where would you go to look for such people?

We have had very helpful service from the Toledo office of the state employment service in seeking applicants for those jobs, and many others of special and regular nature. In looking for the air conditioning engineer, for example, the Toledo employment service relayed the job specifications to all similar offices in Ohio, Indiana, and Michigan. Thus in the short space of a few days we had reports back, and one case history with apparently just the qualifications we were after. A coverage over all offices in the 48 states would have been ours for the asking, had this limited survey not served the purpose.

The state employment service offices are related, one to the other, through the U. S. Social Security board, and this relationship is what makes the coverage just mentioned so widespread—and prompt. It would have been difficult and time consuming for me to locate this engineer with special qualifications, but here is a tax-supported medium for doing just this sort of thing. Of course, the usual interviewing procedure was still necessary, but we have found that the Toledo employment service office—and I presume other similar offices as well—can and will connect openings with applicants when requested to do so.

In fact, so helpful have we found this service, that all likely looking applicants for jobs at our employment window are sent to the Toledo employment service office for test. If the tests show an *A* or *B* rating, and there is an immediate opening, the applicants are hired. This action is taken both with office clerical workers and with factory workers where manual dexterity is a factor.

While psychological tests cannot be taken alone as a positive indication of particular abilities, since interests, background, physical characteristics,

and other qualities must be appraised, yet such tests do give an additional indication of fitness. However, we find that workers ranking high in the tests given are more successful on the job than those ranking low.

Clerical applicants are given a general intelligence test, a spelling test, a group of tests specially designed for clerical workers, and an eye examination. Clerical work is much the same from company to company, but selection of workers for our operating departments does present a problem. If a worker remained on the same job day in and day out, we could hire almost anyone, but when a worker must change jobs frequently—eight times a day is not unusual in our plant—it is important to have versatile workers who can change rapidly from job to job without too much time lost in getting the hang of what should be done.

Tests Aid in Selection

These requirements in our operating departments render tests given by the employment service very helpful in making proper selections. A spatial relations test is given where the job involves the handling of objects with a need for seeing relationships between these objects, such as in sorting, in inspecting, and in assembly work. This test, together with the formboard test which indicates ability to form relations mentally, indicates ability to plan work and carry it out. In addition, manual dexterity, two-hand coordination, and finger and plier dexterity tests are included. The eyes of the applicants are tested also.

As I have said, this service aids in the selection of versatile workers—workers who on one job may be operating a 5-spindle drill press, and on another a kick press, or who may be engaged in wiping off parts on a third. When the applicants are sent back to us with their scores in these tests determined by appropriate psychological procedures, we have then only to evaluate intangibles, such as outside interests and background.

Thus, in addition to finding special talent and experience through the clearance procedure, we have found the employment service of great assistance in testing for the existence of aptitudes of importance in our type of work. I should like to suggest to employment managers who have not already done so that they get in touch with the local employment services of the state compensation commission. They can and will be helpful in the ways just indicated. In a period of rising demands on the time of the employment manager, this is no small contribution.

Spatial relations test measures the ability of the applicant to discriminate among—and work with—odd sizes, shapes, and forms. A high score in this trial indicates skill needed by designers, engineers, draftsmen, assembly workers, etc. Each man is given four trials on each test, and he does not know which of them is selected as his record. He is first allowed to handle or "play with" the devices used in these tests, which provides a sort of "warming up" process that dispels self-consciousness or fear

Most factory work involves the use of tools. The plier movement test measures ability to handle small tools skillfully, which is important in a wide variety of jobs. This man must fit pegs into tiny holes and remove them, keeping pegs in order as instructed

Nimbleness of fingers and coordination of hand muscles are examined in this manipulation test. Round pieces must be picked up in regular order and placed in the proper holes in the correct progression. Since the installation of these techniques, Ohio personnel managers have been able to select men who have been tested for the abilities involved in specific jobs. Correct measurement of ability and proof of it to the applicant saves him from going to work for which he is not fitted, protects him from disappointment. Equally important, perhaps, it saves industry the time and expense of training men who would not be able to measure up to the needs of defense production

Safety Is Safest Under Medical

Growing attention to occupational health hazards puts safety and health departments on common ground. Medical control can lessen accidents, as this case shows

M. L. ROBB

Medical Department, Westinghouse Electric & Manufacturing Company
East Pittsburgh

OCCUPATIONAL DISEASE HAZARDS have taken a place of equal importance with accident prevention since many such diseases have become compensable. Safety engineers and safety departments have come a long way in the prevention of accidents, but they cannot be expected to cope with the occupational disease problem alone, because their knowledge of health conditions is usually limited. Plant medical departments, therefore, must necessarily take the lead in lowering such hazards. If success is to be obtained, close cooperation is necessary between medical and safety departments.

This company recognized the value in eliminating health hazards, as well as accident hazards, long before compensation laws were changed to include occupational diseases. Since the work of the safety department is so closely allied with that of the medical department in keeping the employee on the job, the two departments have been brought under one management, with resulting advantages. This plan has been working satisfactorily for several years. The accompanying chart illustrates the coordination of this entire activity under a medical director.

The employment department is shown in the chart for, although it does not function under the medical director, it works in close harmony with him. The medical examiner is able to make a physical examination of the applicant that will insure against placing him in work that is not suited to his physical condition or that may endanger those around him. He also specifies whether the worker is to receive periodic examinations, and how often.

Since the safety engineer becomes a part of the medical department, he is now in a position to do a better job. He

Safety Shoes Save Toes and Time
Isadore Swartz, Section M-14, Check 36, while removing a shaft from a mandrel accidentally let the shaft drop. The shaft which weighed 115 pounds fell 28 inches and landed on his foot. He continued to work as his safety shoe saved his toes.
Poster No. 8

Typical poster in safety shoe campaign cites specific case where a safety shoe saved an employee's foot, mentioning the man's name

Supervision

also has more varied duties, such as distributing material for a health education program, established each year by the medical director, which includes subjects on general health and working conditions. The safety engineer should follow all recommendations made by the medical department or the industrial-hygiene engineer. These duties are in addition to his former position as purely a safety man.

One important requirement in any field of endeavor is the knowledge of existing conditions. A satisfactory remedy cannot be applied to correct a condition unless the cause is known. The industrial-hygiene engineer and laboratory are possibly the most potent factors in determining the hazards involved in existing conditions. The work is not limited to discovering hazards in conditions and equipment, but in reviewing contemplated new materials, new processes, and new buildings or plant layouts. Costly changes are avoided by a study of original plans and specifications in proposed new processes or buildings.

An objection to this whole plan might be that it is costly. On the contrary, many plants undoubtedly have all these departments now, but under separate heads, with the possible exception of the industrial-hygiene laboratory. For small plants not able to support such a laboratory, the state laboratory offers similar service at little or no expense.

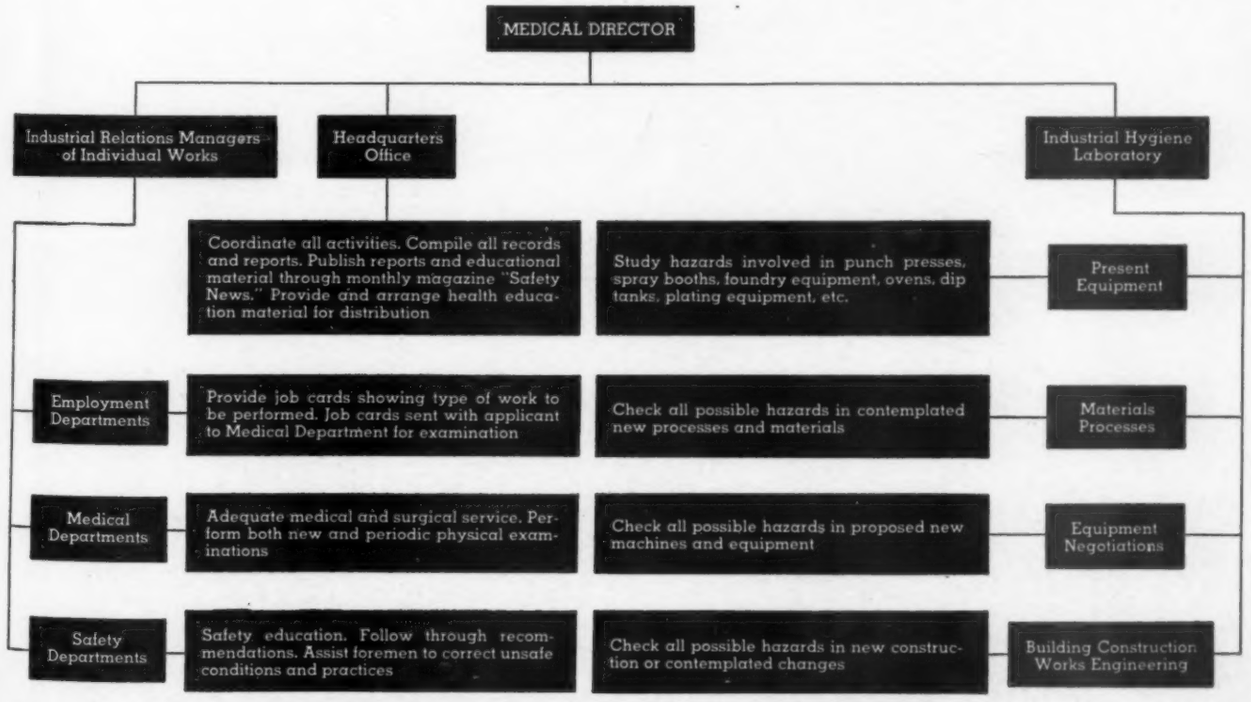
Consider the costs of a safety and health program. A reliable estimate shows that the indirect costs to industry of its accidents is four times the actual compensation paid to the injured employees. Therefore, if compensation payments amount to $1,000 for one month, the total cost would be $5,000. If an effective program will reduce compensation expenses 50 percent, it will reduce indirect cost 50 percent as well. On the basis of the same figures mentioned before, this program will bring total costs down to $2,500. An intensive program would probably cost $1,000 more per month, but it would save $2,500, which represents a net saving of $1,500.

These indirect costs are real costs when analyzed closely. When an employee is injured or develops an occupational disease, someone must be trained to do that job, someone must teach him, and some costly material may have to be scrapped while he learns the job. If the incapacitated person is not replaced, there will be a loss of productive hours, and an expensive machine which must be depreciated whether used or not will stand idle. And these may be only a few of the indirect costs that accompany an accident. When a safety and health program is in effect, experience proves that the general health and quality of

(*Continued on page 164*)

Accident Frequency

	Hours Worked	*Accidents*	*Days Lost*	*Frequency*
1937				
Works	82,294,768	698	36,872	8.5
Service	5,603,083	116	7,304	20.7
Total	87,897,851	814	44,176	9.25
1938				
Works	55,423,833	267	19,137	4.8
Service	4,608,536	98	7,668	21.2
Total	60,032,367	365	26,805	6.1
1939				
Works	66,754,498	240	42,330	3.6
Service	4,876,854	59	13,909	12.0
Total	71,631,352	299	56,239	4.17


MEDICAL DIRECTOR
Industrial Relations Managers of Individual Works
Headquarters Office
Industrial Hygiene Laboratory
Coordinate all activities. Compile all records and reports. Publish reports and educational material through monthly magazine "Safety News." Provide and arrange health education material for distribution
Study hazards involved in punch presses, spray booths, foundry equipment, ovens, dip tanks, plating equipment, etc.
Present Equipment
Employment Departments
Provide job cards showing type of work to be performed. Job cards sent with applicant to Medical Department for examination
Check all possible hazards in contemplated new processes and materials
Materials Processes
Medical Departments
Adequate medical and surgical service. Perform both new and periodic physical examinations
Check all possible hazards in proposed new machines and equipment
Equipment Negotiations
Safety Departments
Safety education. Follow through recommendations. Assist foremen to correct unsafe conditions and practices
Check all possible hazards in new construction or contemplated changes
Building Construction Works Engineering

Both accident and occupational health hazards are controlled by this organization scheme which is coordinated by the medical director

Built Without Windows to Insure

Buda's new plant producing aviation-type diesels is windowless and air conditioned, assures control of temperature, light, and cleanliness, thus guaranteeing high-precision parts and everlastingly controlled quality

R. K. MANGAN

Executive Vice-President, The Buda Company, Harvey, Ill.

WHEN WE UNDERTOOK last summer a sizable contract for tank engines of the radial Guiberson diesel design, we erected a substantial addition to the plant in which we were beginning to make these engines for airplane use. Our nucleus plant was a brand-new building specifically designed for a smaller production of this product. But in the brief period of its use we had discovered ways in which to make the addition still better.

To go back a year or so, these aviation type diesels were originally built by the inventor's own organization at Dallas. The plant was a sheet-metal building with large sawtooth windows overhead, and the building caused a great deal of trouble in the manufacturing process. The engine requires utmost precision, as witness that we are manufacturing all parts and assembling within limits of plus 0.0005 inch and minus 0. Therefore a minute change of dimension of any part can be a serious impediment to production.

At the Dallas plant a jig borer was set up right under a sawtooth. The men who moved up from that plant to our present building still talk about that jig borer and its odd behavior. At about 10 a.m. of any clear day, the Texas sun came streaming in and hit the jig borer. Within five minutes the assembly and any parts that the sunshine caught would be out from three to seven tenths, and there was no way to compensate for those erratic shifts of size. They simply had to suspend operations on the jig borer until a sun shade was installed to eliminate changes taking place in the alignment.

When the first plant unit was built to transfer production of the Guiberson engine to our factory near Chicago, we

Controlled lighting—it's fluorescent—makes it possible for Buda to maintain uniform workmanship throughout the three shifts

Top Quality

profited by the Texas experience. It was apparent that we should be better off in an air-conditioned building where we could control the temperature and thus hold our limits more easily. So we put up a small building with the necessary equipment, and it worked well, except —it was built with some overhead windows. And from time to time the heat radiated from outdoors, with or without direct sunshine, gave us a little of the same old trouble that accompanies uneven temperatures in a high-precision metal-working shop.

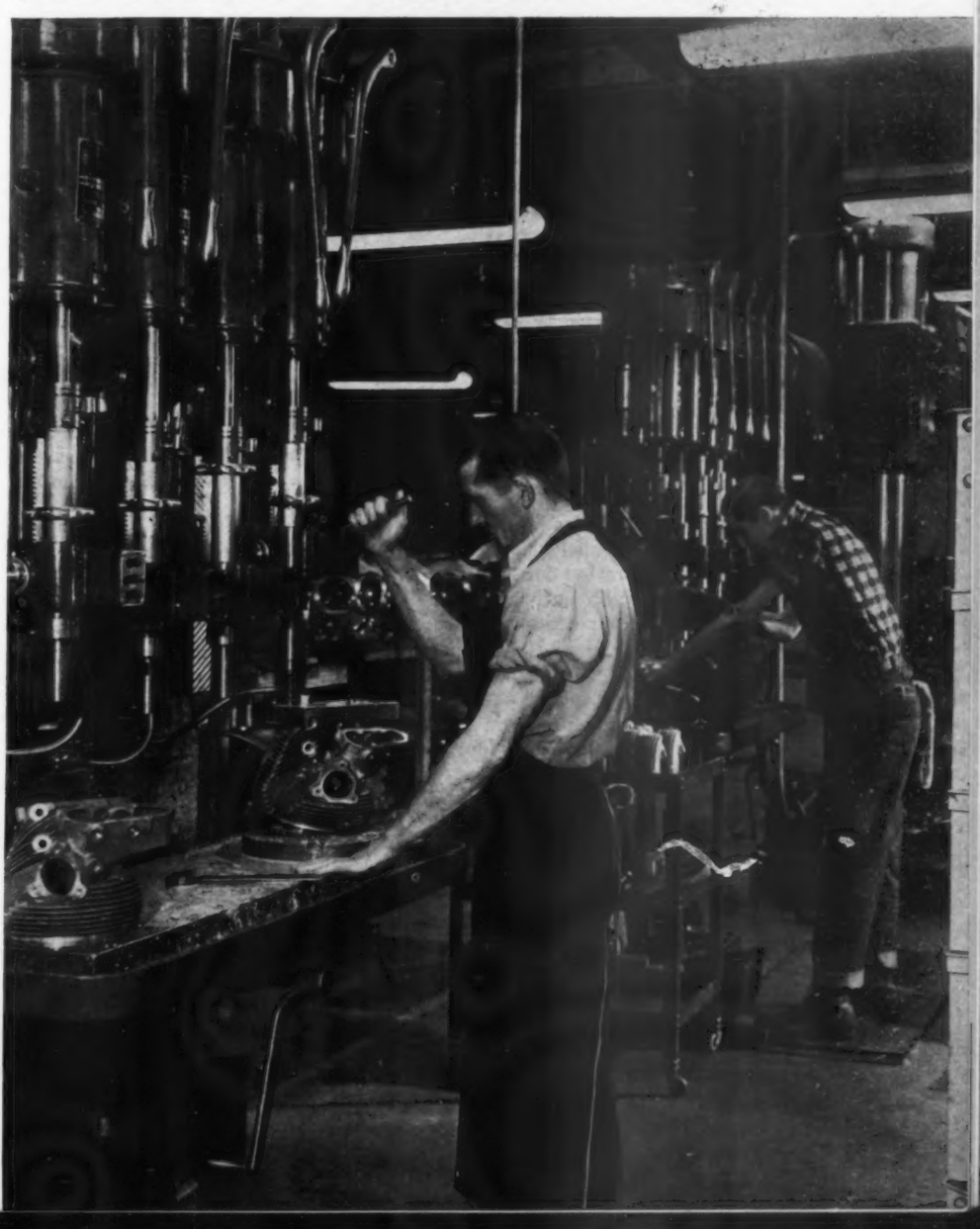
Therefore, when we put up our big addition for the defense order, we decided to go the entire way. We built it without windows, air-conditioned it, installed fluorescent lighting of a high level. The consequence is a plant in which we control the temperature and light. By maintaining these close to the ideal points, we are able to produce parts and assemble them with full assurance that they are not distorted by temperature differentials. An enlightening commentary is that in the original unit, with its skylights, we set up those machines that do the roughing out. From this daylighted end of the building, the work moves to the new section where it is not subject to the erratic and unpredictable effects of Mother Nature.

Quality First

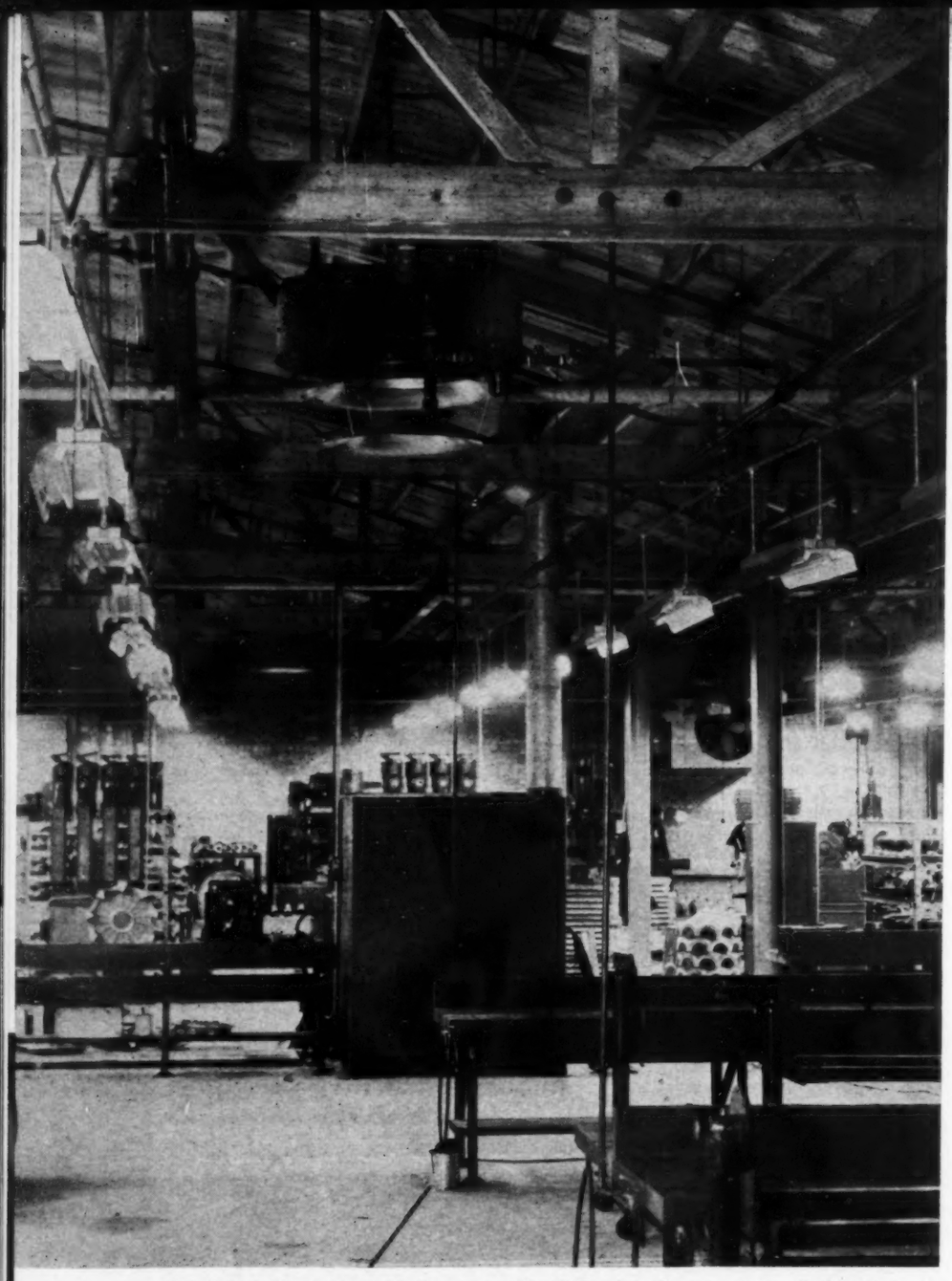
Primary purpose of the windowless, air-conditioned building is to give us control of conditions of temperature, light, and cleanliness, and thus to bring about the constant controlled quality of production. To give an offhand example, without these conditions one man may work on the lower half of the crankcase in the morning, keep it within the accepted limits. Another man, working that afternoon on the upper half of the crankcase, would keep his part within the same limits. But, because of different temperatures inside the building in morning and afternoon, when the two parts came to be assembled together that same evening, they would be off and would have to be rejected. Under actual conditions in our new plant, this cannot happen because temperature and light are always the same, no matter whether it is 90 or zero on the outdoor thermometer, no matter whether the sky is bright blue or overcast for a blizzard.

Sole entrances to the radial diesel building are through airlock chambers;

Common-brick wall was inexpensive. Wood-truss roof construction enabled Buda to get its windowless building up faster than if a more conventional overhead design had been used



By keeping temperature and light close to ideal points, Buda is able to produce engine parts and assemble them with the full assurance that they will go together as planned



Circulators blow warm air down to strike bells that disperse it in all directions; in summer they churn down dead air that accumulates under ceiling like a heated blanket

even the loading and unloading dock is conditioned and controlled, and serves as an airlock. The reason for this precaution is that we continuously maintain inside the building a positive pressure of approximately a tenth of a pound per square inch—from 2 to 2½ inches of water. Thus any leakage is outward, and the building is free of any infiltration of outdoor dust. Since our plant is large, and we have other heavy-industry neighbors close by, the importance of excluding dust and grit from buffed, honed, and lapped precision surfaces should be apparent.

Construction of the building is perhaps unusual for industrial use. The walls are common brick. The roof is of wood-truss construction, domed up like so many one-story service garages. This construction is inexpensive, and it permitted us to get the building up faster than if we had used a more conventional type of design overhead. But also it fits beautifully into our purpose to control temperature. In the top of each dome, which means over each bay, we have set exhaust blowers. The conformation of the roof draws the hot, stale air into these domes, and the blower vents it. Thus each blower drains an entire roof-truss floor area.

From inside the roof looks like an ordinary garage roof. From outdoors, it shows a mopped felt surface covered with gravel except on the sharp pitch. Beneath the felt, however, is a layer of insulation which combines the functions of acoustical absorption and heat resistance. Consequence of the acoustical quality is the comparative quiet of our shop. Consequence of the thermal quality is a lower heat loss through the roof in winter, a lower radiation input of solar heat in summer.

Cooling water from our deep-well system is brought in at an average temperature of 48 degrees Fahrenheit in summer, circulated through coils in the blower units. Exhaust steam is circulated in winter through a separate set of coils in the same blower units. Thus, depending upon which coils are in use, the blower circulates warm or cool air.

In addition to these units that draw air through the coils for cooling or heating, we have in each bay two high-steam heaters for maintaining the divisional temperature and to pick up any loss from outdoor cold. These coils are thermostatically controlled, so that they turn on the circulating fans when the temperature at working level drops below 70 degrees. The circulators blow the air directly downward, to strike bells that disperse it in all directions. During the present winter, as this is written, the auxiliary heat has been turned on only a few times, because of the unusually mild weather. But when the thermometer outside has dropped toward zero they have come on and supplemented the big units that work from exhaust steam.

Cool in Summer

We can use these same circulators in summer to help us maintain 70 degrees —by reversing the process. In warm weather we expect, of course, to cut off the steam at the header valves. Then, by setting the thermostat lower than 70, we shall have the circulators turning on and churning downward from above the dead air that tends to accumulate under the ceiling as a heated blanket.

As for lighting, we have all fluorescent in the new addition, and are steadily replacing from the nucleus of this plant the incandescent drop fixtures which were installed less than a year ago. The reason is that the fluorescent, with white tubes rather than the more usual "daylight blue" tubes, give so much more satisfactory working light at so much lower cost. The only time we have tested our lighting level in the new section was before the machinery was installed. At that time we had 36 to 37 foot-candles 12 inches above the floor, so that we doubtless have upwards of 50 foot-candles at bench level.

Besides the production advantages outlined, the controlled lighting and heating give us ideal working conditions for the personnel and permit us to maintain uniformity of workmanship through the three shifts that we work. They tend to give us better accuracy and speed. And they are certainly excellent for the health of the men.

How Many Automatics Should a Man Run?

No brief for the speed-up, but a way to find out if Joe Doakes has too many machines to attend—or not enough

PHILIP BERNSTEIN
Time-Study Department
Winchester Repeating Arms Company
New Haven

WHETHER OR NOT an operator has too many or not enough automatics to attend, has always been a moot question. There is a certain point at which both the employee and the management get their greatest returns, and this point or basis cannot be determined without study. If production is the only consideration, one machine per operator is the ideal basis. However, if cost of product is to be considered, then the correct number of machines per operator must be calculated, and in such a case the laws of probabilities enter. It goes without saying, also, that an operator must receive added remuneration per hour for each additional machine he attends.

This paper is not written as a brief for the speed-up or the stretch-out, but is simply an attempt to clarify a situation that is often arranged by a foreman in a hit-or-miss manner. After the basis of machines per operator has been established by probabilities, the operator must be satisfied that the basis is a just one, and it may require a man with the patience of a Job to stick with the operator until the latter is thoroughly satisfied and the determined basis is actually in effect and workable.

We have an actual case where one operator runs 3 and another runs 4 similar machines. A delay study has been made of these machines resulting in the analysis in Table I.

For purposes of multiple-machine basis, only the stocking-up item need be considered in relation to the running time, because on other items the adjuster and not the operator does the work; i.e., on tool or machine breaks. The stocking-up time was 290.05 minutes and the running time 4,339.65 minutes. Therefore, considering only these two items, the stocking-up time, or the time when the operator is occupied, is 6.2 percent of the total, and the running time is 93.8 percent. Machine and tool delays amount to 269.90 minutes, and personal delays are arbitrarily set at 30 man-minutes per working day. Machine and tool delays amount to 5.8 percent of total time.

Let's look at the bases from one machine up, considering only stocking-up and running time. Figures at the right indicate number of machines down at one time:

1-Machine Basis

0.0620 — 1 machine down
0.9380 — 0 machine down

1.0000

2-Machine Basis

$(0.062)^2 = 0.0039 - 2$
$(0.062) \times 0.938 \times 2 = 0.1163 - 1$
$(0.938)^2 = 0.8798 - 0$

1.0000

3-Machine Basis

$(0.062)^3 = 0.0002 - 3$
$(0.062)^2 \times 0.938 \times 3^* = 0.0108 - 2$
$0.062 \times (0.938)^2 \times 3^* = 0.1637 - 1$
$(0.938)^3 = 0.8253 - 0$

1.0000

* There are three possible combinations of three things taken two at a time or taken one at a time.

4-Machine Basis

$(0.062)^4 = 0.0000 - 4$
$(0.062)^3 \times 0.938 \times 4 = 0.0009 - 3$
$(0.062)^2 \times (0.938)^2 \times 6 = 0.0203 - 2$
$0.062 \times (0.938)^3 \times 4 = 0.2047 - 1$
$(0.938)^4 = 0.7741 - 0$

1.0000

5-Machine Basis

$(0.062)^5 = 0.0000 - 5$
$(0.062)^4 \times 0.938 \times 5 = 0.0001 - 4$
$(0.062)^3 \times (0.938)^2 \times 10 = 0.0020 - 3$
$(0.062)^2 \times (0.938)^3 \times 10 = 0.0317 - 2$
$0.062 \times (0.938)^4 \times 5 = 0.2400 - 1$
$(0.938)^5 = 0.7262 - 0$

1.0000

Table I—Delay Analysis (7 Machines—2 Operators)
(in minutes)

Machine Number....	3411	3437	3436	4196	3432	3434	3409	
R.P.M.....	115	115	127	119	122	122	135	Total
Personal Delay.....	1.60	0.35	2.50				0.65	5.10
Broken Tool.....	111.70			9.90			26.75	148.35
Stocking Up[1].....	34.45	39.45	53.30	39.50	36.35	43.85	43.15	290.05
Adjust Machine.....	78.85		9.50			33.20		121.55
Machine Down[2]....	5.40	5.60	11.65	12.00	8.90	5.15	13.30	62.00
Wait for Work Containers[3].....			30.85	10.80	10.00	10.65	11.00	73.30
Total Delays.....	232.00	45.40	107.80	72.20	55.25	92.85	94.85	700.35
Time On Study[4]....	720.00	720.00	720.00	720.00	720.00	720.00	720.00	5,040.00
Running Time.....	488.00	674.60	612.20	647.80	664.75	627.15	625.15	4,339.65
Efficiency Percent...	68	93.5	85	90	92.5	87	87	

[1] One machine down only — no loss in efficiency over a 1-machine basis.
[2] Machine down while operator is occupied on another machine that is down.
[3] This item will be eliminated — more containers purchased.
[4] Not continuous — three different days.

Table II—Earnings and Costs

Basis	*R.P.M.*	*Eff.*	*Task*	*Hourly Earnings*	*Labor Cost per M*
1.....	122	83.0	6070	0.45	$0.074
2.....	122	82.6	12050	0.50	0.0415
3.....	122	81.9	18000	0.55	0.0305
4.....	122	80.7	23600	0.60	0.0255
5.....	122	79.2	29000	0.65	0.0225
6.....	122	77.2	33800	0.70	0.0205
7.....	122	75.0	38400	0.75	0.0195
8.....	122	72.3	418000	0.80	0.019

(Continued on page 156)

Tool Steel Control Cuts Much

Full details, with complete paperwork, of an inventory control plan that reduced tool steel stocks to the tune of exactly $5,615.17 the first two years it was in use

R. F. NORTMAN and W. S. HANSEN

Production Engineers
Harley-Davidson Motor Company, Milwaukee

PRIOR to the installation of this system, requests on the purchasing department for tool steel were made out by the storeskeeper. Quantity to order was determined wholly by judgment, with no historical data derived from past disbursements to guide the storeskeeper when requesting new purchases. An unreasonably huge stock was inevitably acquired over a period of years.

To begin with we made a detailed physical inventory of the tool steel on hand. There were duplicates of analyses, and there were odd sizes that were obsolete. There were also steels of analyses that were no longer manufactured, an indication that they had been in stock for years without an attempt to use them up.

We found, all told, that we had 20-odd kinds of tool steel on hand. After careful investigation and a study of our production requirements, we have been able to boil the list down to six types.

This was the goal we set. We intend to stock only these steels and we limit purchases of new steel by using up the unwanted brands wherever feasible. However, in some cases a steel not used in sufficient quantity to be carried in stock will be ordered for a specific job. For example, a blanking die for high-silicon-steel generator blanks requires a high-carbon, high-chrome die steel. This steel is not stocked, but is ordered in just enough quantity for that one job. Large diameters also are not stocked, but are ordered as needed.

Next we set up a code of mnemonic

TOOL STEELS

BRAND NAME	SYMBOL	TYPE	IDENTIFICATION COLOR STRIPE	MATERIAL CLASS NO.
CARBON TOOL STEEL GROUP (WATER HARDENING)				
KLOSTER STANDARD	C-1R	STRAIGHT CARBON	SILVER	23743
LATROBE C.E.M.	C-1F	STRAIGHT CARBON	RED	23742
LATROBE STANDARD	C-2F	STRAIGHT CARBON	RED AND BLUE	23744
COLUMBIA SPECIAL	C-4H	CHROM-VANADIUM CARBON	RED AND WHITE	23747
COLUMBIA DOUBLE SPECIAL	C-5H	HIGH CARBON TUNGSTEN + CHROM.	RED AND GRAY	23748
CARPENTER SOLAR	C-6K	SILICON MOLYB. CARBON	GREEN AND WHITE	23749
MANGANESE TOOL STEEL GROUP (OIL HARDENING)				
COLUMBIA OILDIE	MN-1H		YELLOW + BLUE	23755
COLUMBIA EXL-DIE	MN-2H		WHITE + BLUE	23756
LATROBE MANGANO	MN-2F		GRAY + BLUE	23757
COLUMBIA SUPER-DIE	MN-3H	HIGH CARBON HIGH CHROMIUM	ORANGE	23758
KLOSTER SWED-OIL	MN-4R		YELLOW + WHITE	23759
TUNGSTEN TYPE, HIGH SPEED TOOL STEEL GROUP (OIL HARDENING)				
CARPENTER STAR-ZENITH	T-1K	18-4-1	2 GREEN STRIPES	23765
MIDVALE 2-STAR	T-1L	18-4-1	GREEN + YELLOW	23766
COLUMBIA CLARITE	T-1H	18-4-1	GREEN + BLUE	23767
COLUMBIA VANITE	T-2H	18-4-2	WHITE	23768
CRUCIBLE REX AAA	T-4X	18-4-1+4	3 GREEN STRIPES	23769
COLUMBIA MAXITE	T-8H	14-4-2+5	RED AND GREEN	23770
CHROME NICKEL STEEL				23762
MACHINE STEEL				23763
MISC. C.R. STEEL				23764
BRASS				23537

M C NO. _____
NAME _____
DESCRIPTION _____
UNIT _____

DATE	DEPT.	DISBURSED	TOTAL DISBURSED	ON HAND
10-31-40		FROM	CARD #1	8¼*
11-5	16	8¼	8¼	—
11-6		RECEIVED		59*
11-12	16	6	14¼	53
11-25	23	½	14¾	52½
11-25	23	¾	15½	51¾
11-26	8	2¾	18¼	49
12-2	16	2	2	47
12-6	16	3½	5½	43½
12-13	16	5	10½	38½
12-18	16	4½	15	34
LATROBE	C.E.M.	1/2 ROUND		

←

Fig. 1. This chart shows mnemonic symbols and colors with which each bar of steel is marked. In extreme right-hand column is listed class number of each kind of steel for cost department's use

Too Much to Just Enough

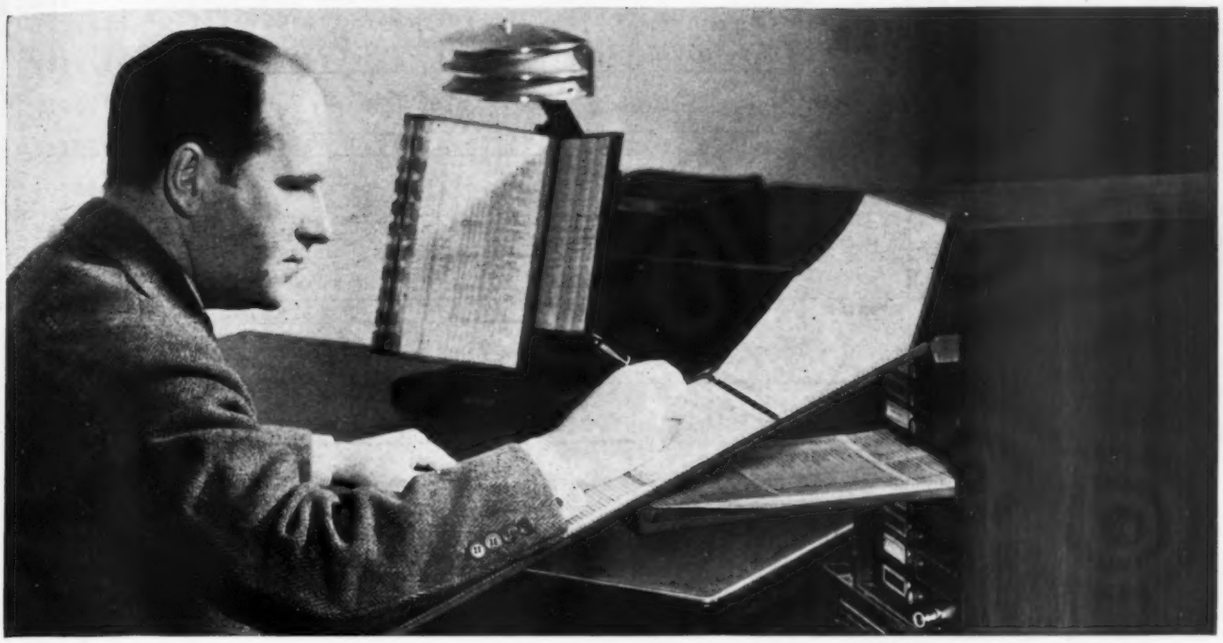


Figure 2 (above). A visible file system was developed with a 5 x 8 card for each brand and size of steel. Card is shown at the left and below in Figures 3 and 4

SUPPLY RECORD
HARLEY-DAVIDSON MOTOR COMPANY

ORDER POINT 10#

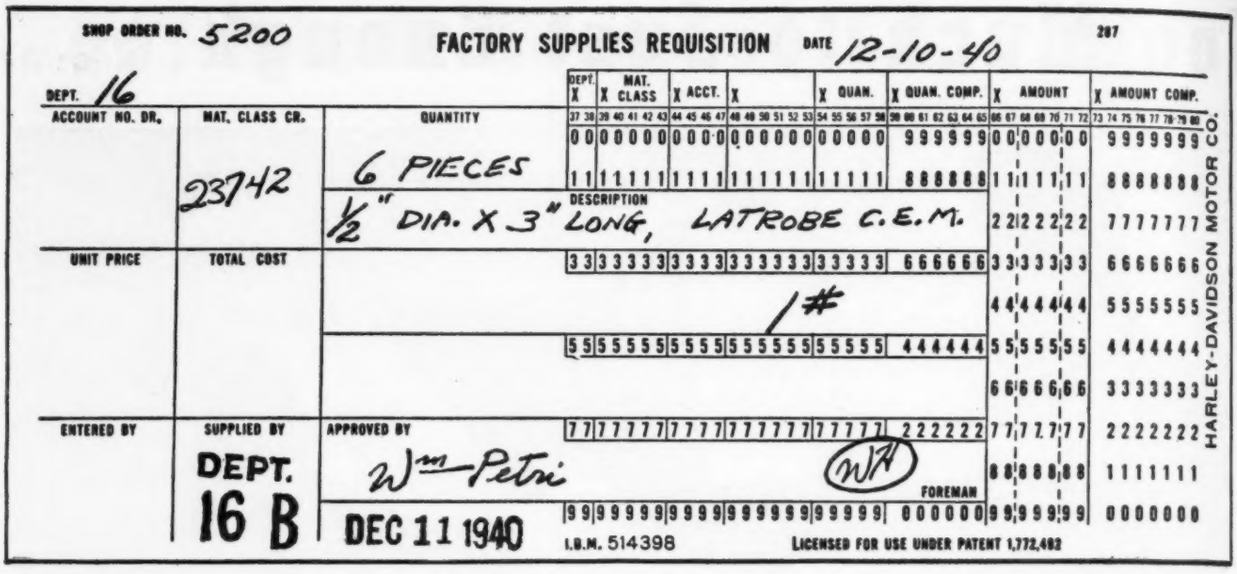
AMOUNT TO ORDER 7 BARS

DEPARTMENT _____ WEIGHT .67 FT. CARD NO. 2

DATE	DEPT.	DISBURSED	TOTAL DISBURSED	ON HAND	DATE	DEPT.	DISBURSED	TOTAL DISBURSED	ON HAND

Figures 3 and 4. When this system was started there were over 900 inventory cards in the file. Their number has now been cut to 560. This was done by limiting new purchases, using up surpluses

ON ORDER			RECEIVED			RECEIVED			REMARKS		
DATE	AMOUNT	ORDER NO.	QUANTITY	WEIGHT	DATE	QUANTITY	WEIGHT	DATE		1939	1940
10-31-40	7 BARS	F-11890	89½ FT.	59#	11-6-40				JAN.		6¾
									FEB.		13
									MAR.		9
									APRIL		¾
									MAY		7
									JUNE		5¼
									JULY		10
									AUG.		12
									SEPT.	8½	6½
									OCT.	12¼	5½
									NOV.	8¼	18¼
									DEC.	—	



SHOP ORDER NO. 5200

FACTORY SUPPLIES REQUISITION DATE 12-10-40

287

DEPT. 16

ACCOUNT NO. DR.	MAT. CLASS CR.	QUANTITY	DEPT. X	MAT. CLASS X	ACCT. X	X	QUAN. X	QUAN. COMP. X	AMOUNT X	AMOUNT COMP.
	23742	6 PIECES								
		½" DIA. X 3" LONG, LATROBE C.E.M. (DESCRIPTION)								
UNIT PRICE	TOTAL COST									
		1#								
ENTERED BY	SUPPLIED BY	APPROVED BY								
	DEPT. 16 B	Wm Petri (WM) FOREMAN								
		DEC 11 1940								

I.B.M. 514398 LICENSED FOR USE UNDER PATENT 1,772,482

HARLEY-DAVIDSON MOTOR CO.

Figure 5. Foreman writes order on the steel room. Cut-off saw operator fills requisition, stamps department number and date on the order, fills in the weight. From there the order goes to the production engineering department. Clerk posts disbursement to card, initials requisition to show that it has been posted, and then sends card to cost department for allocation to job order

symbols and colors (Figure 1) with which each bar of steel is marked for positive identification. The mnemonic symbols are stamped on the end of each bar and the color is painted on. This has eliminated confusion and facilitates selection of the correct steel from the storage rack. The mnemonic symbols are an expansion of the symbols developed by Mr. L. C. Gorham for classifying high-speed steels. We went a bit further and applied this method to carbon and oil-hardening steels.

The next step was to set up an inventory file with a card for each brand and size of steel. A simple visible card file (Figure 2) was developed. The selection of a record card was simple; we used one (Figure 3) that was in use in the shop supply storeroom, and with the addition of a monthly consumption record on the back (Figure 4) we were all set.

Posted Every Day

Following this we had all the steel requisitions (Figure 5), which are made out by the toolroom foreman and filled by the saw operator, sent directly from the cut-off room to the production engineering department for daily posting on the inventory cards, and from there they are sent to the cost department for allocation on job orders.

You will note (see Figure 3) that the posted disbursements are in monthly totals. At the end of the month this total is transferred to the back of the card in the space provided. From these totals the order point and the amount to order were set up, and from these data we can discern any unusual increases or decreases in consumption so that the order point and amount to order can be changed to conform. The clerk who does the posting also automatically sends orders for new purchases to the purchasing department.

As everyone knows, any system of this type is effective only if careful analysis is made of the accumulated data. It does, however, make analysis simpler, and the data are set up in such fashion that it is not necessary to wade through row on row of figures to arrive at the correct result. The necessary clerical work is done economically. That it is all worth while, is proved by the reduction in inventory.

Training by Correspondence

Need help with training? ICS has 2,290 cooperative training plans in force. And 45 universities and colleges offer extension courses

FOR MANY BUSINESS and industrial organizations, the correspondence method is the only practicable method to train personnel. Few corporations can economically employ special teachers qualified to conduct lectures and lesson-correction service for employees in a variety of occupational fields, especially where some of the groups are quite small. Often there are several widely separated plants, further complicating the problem of mass teaching. Instruction by correspondence, however, is almost always feasible and adaptable to any type of organization.

Twenty years ago the International Correspondence Schools of Scranton, Pa., organized a cooperative training division to work more closely with management in its varied training activities. Today 2,290 separate cooperative training arrangements are in effect with industrial organizations, trade unions, and other agencies.

The ICS industrial training activities can be broken down as follows:

1. Cooperation with one company.

2. Cooperation with a single agency in a community, where many industrial organizations may participate. An illustration is the program being conducted with the Fox River Valley Manufacturers' Association of Aurora, Ill. The apprentice training agreement is with the association in which 19 companies are actively participating.

3. A cooperative plan where a program is sponsored by one agency in which companies located in several communities may participate. To illustrate, there is an agreement with the Tri-City Manufacturers' Association,

(Continued on page 166)

Management Shorts

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary management accomplishments. Accepted articles will be paid for

PRODUCTION PLANNING AND CONTROL

"Waste Labor Report" Shows Up Extra Work

JOSEPH M. ROBINS, *General Manager*
Yankee Metal Products Corporation
East Norwalk, Conn.

In our factory, as in many others, too often it is found necessary to expend labor on operations that are not part of the standard labor set-up on the particular item. The causes for such additional labor, which can be termed waste labor, are varied. Sometimes a part is incorrectly ordered by the purchasing department, sometimes a part comes in incorrectly made and there isn't time to return the shipment to the supplier, sometimes the additional labor is necessary to correct a condition caused by our own manufacturing method. Whatever the reason may be, the fact remains that this labor is something that was never figured into the original cost of the item and certainly something that should be kept down to a minimum —eliminated entirely, if possible.

Previously, each foreman took it upon himself to authorize this additional labor and, frequently, no one else knew of the necessity for this waste labor. As a result, nothing was done to rectify the original condition that had caused the waste labor; so the situation kept on repeating itself until the waste labor became so much a matter of habit that everybody thought that it was part of the standard operations.

To control this unnecessary waste labor, it was deemed advisable to make it a matter of record. A waste labor report was designed. This report is made up in duplicate. The original is pink, and the duplicate is green. The power to authorize this labor was put into the hands of only several executives identified with factory work. Instructions were issued that at no time was any labor to be expended on operations that were not part of the standard operation routine, unless authority had been granted by the issuance of such a waste labor report.

The duplicate or green copy would remain at the point of operation, acting as a written authorization for the work. The original, or pink copy would go into the office of the general manager. It would serve to notify him that this waste labor was being incurred, and would give him an opportunity of checking the reasons and discovering a method of eliminating the condition.

Orders to put into effect whatever would be necessary to eliminate this waste labor would then be issued. The original is then filed according to part number, and if waste labor should be authorized again on this very same part for the very same reason, it would immediately come to notice as an indication that the party charged with eliminating the difficulty had failed to do so.

WASTE LABOR REPORT

DATE_____ ITEM NO._____ PART NO._____

PART_____

QUANTITY RECEIVED_____ DEFECTIVE_____

DEFECT_____

NECESSARY OPERATION_____

OPERATORS_____ HRS._____ RATE_____ COST_____

REMARKS_____

AUTHORIZED BY_____

•

Floor sweepings passed through a series of sifters and separators that salvage rivets, bolts, other small items, yield $12,500 worth of salvage a year.

•

12762	Trap, Air (Comp.)
12769	Flange, Water Heating Conde
12778	Pad, Weight
12780	Bushing, Fric. Pulley
12785	Guide, Cable
12786	Pulley, Friction (Comp.)
12787	Bushing, Fric. Pulley
12789	Spring, Fric. Pulley
12791	Strainer
12792	Plate, Name or Number (U.S.)

How Stocks of Obsolete Parts Are Controlled

VINCENT D. AMODEO and OAKLEY F. HALL

Factory Accounting Department
The De Laval Separator Company
Poughkeepsie, N. Y.

The machines we manufacture have a long life, and, therefore, parts replacement service becomes a real problem. In the past 60 years 19,000 different parts have gone into the assembly of machines. It has been our policy to furnish replacement parts, within reason, for almost any machine in use.

To cope with this problem a management committee decides from design changes and a study of inventory and usage records, compiled by the accounting department, which parts are to be classed as inactive.

A list of these parts is typed on flexi-

ble "Linedex" strips and inserted in panels. This list shows part number and name of all obsolete parts, either stocked or discontinued. A black, rectangular-block signal denotes parts remaining in stock.

Two or three hundred parts are added to this list yearly, and the strip feature makes for easy revision. The panels are photostated as many times as there is need for copies, bound in book form, and sent to our various branch service, factory inspection, and designing departments.

Our branch service departments put the list to very good use by checking their parts, noting those stocked at the factory which have been classed as inactive, thereby holding their own stock of these parts at a minimum. They also know promptly what old parts there may be at the factory to apply against orders received from the field.

Both the factory inspection and branch service departments immediately discard any parts appearing on the list, which are received from the field in machines or subassemblies. Before the inception of this plan, used parts were shipped to the factory from the branches and users, and if possible were reconditioned and put in stock. Now we do not uselessly spend money for freight, labor, and materials.

PRODUCTION METHODS AND MATERIALS

Quicker, more accurate, to weigh out than to count laminations. Result: better motors

Weighing Replaces Hand Counting and Improves Quality

SOURCE, *Toledo Scale Company, Toledo*

The Birtman Electric Company, Chicago, has stopped counting by hand the metal laminations that go to make up electric motor armatures. For peak motor performance output, armature weight must be held to a close tolerance. Tests disclosed, however, that some armatures were under weight, some over.

Weighing out the laminations instead of counting them, has enabled the company to set up a rigid and accurate control—all of which has resulted in a better and more efficient motor.

•

Changing three small parts on a wire-stitching machine enabled William A. Freedman, Die Cutters, New York, to substitute a ⅜-in. staple for a standard ½-in. staple, saving 16 percent in the cost of stitching wire —a sizable sum in a year's time.

•

Top Stapler Cuts Carton Sealing Costs

W. A. WOOD, *Efficiency Manager*
McKee Glass Company
Jeannette, Pa.

By installing a top stapler we were able to cut labor costs by as much as $15 per day.

We formerly used six girls to do the same amount of work that is now done by three men with the aid of this top stapler, and in addition we find we have much neater and better boxes.

The cost of the staples is much more than offset by the saving in labor. The saving thus accomplished amounts to $5,000 per year.

Management, How Good Is Your Control?

Ask yourself these questions to check up

7. RECORDS

1. Exactly what records are maintained in your unit? What purpose do they serve? What personal use do you make of them?
2. Are you keeping too many records? Any obsolete records? Are there any really important records which you should be keeping?
3. Is too much time spent in keeping records? Could they be revised to eliminate unnecessary information? Are they kept properly? Completely?
4. Are they turned in promptly?
5. Is information gathered put to good use while it is still timely?
6. Do you have any output and quality records? How detailed are they? Are they too general? Too involved? What use is made of them?
7. What can you learn from machine maintenance records? Do they indicate improper machine operation?
8. Do you know how often tools are renewed? How much supplies to order?
9. Have you a reasonably accurate attendance and performance record on each one of your men? Is it too detailed? Not detailed enough?
10. Have you any kind of production volume records pertaining to your activity? Do you know how long it takes to make certain involved assemblies? Have you taken time to investigate and determine why?
11. Have you sufficient production records to enable you to estimate the personnel, space, and equipment necessary to turn out different volumes of work? Or to enable you to estimate time required for special jobs?

Next Month: Inspection

Prepared by HARDING PALMER, *Industrial Engineer*
Lockheed Aircraft Corporation, Burbank, Calif.

MAINTENANCE SERVICES

SELECTION

INSTALLATION

INSPECTION

UPKEEP

ORGANIZATION

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FACTORY MANAGEMENT and MAINTENANCE

McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.

Editorials

MAINTENANCE AS THE EDITORS SEE IT

Good Executives Learn to Delegate Responsibility

WHEN THE WORK and responsibilities of the maintenance department, particularly in smaller plants, expand beyond a certain point the chief may find himself in an uncomfortable spot. Just how uncomfortable that spot is, and how successful he will be in getting off it gracefully depend largely on the chief himself.

The trouble is not of his making, but the blame for some of the consequences is mostly his. He has, to take a typical case, built up a good but small crew that does its work well. The chief is conscientious, supervises every job, sees that every detail is correct. Everything goes along as smoothly as maintenance work can because the chief makes himself personally responsible for it.

Laudable enough in some respects, such a policy may be carried to the point where it has serious drawbacks.

These drawbacks become apparent when the amount of work increases so much that the chief finds he cannot be in two or three places at once, to supervise all the new men and all the new jobs. The way in which he meets this situation is one measure of his executive ability.

The right way, of course, is to select one or more dependable, experienced men and make them responsible for the proper performance of all work whose importance does not demand the personal attention of the chief.

Failure to take this step is certain to result in neglect of matters that in the long run are essential to the proper direction of the maintenance department.

Neglect of Piping Systems Costs More Than Care

AMONG THE IMPORTANT plant service facilities that are allowed to grow unhampered, piping systems are usually away up in front. In the hurry to get work done as quickly as possible it is easier to hook onto the nearest branch, rather than go back to a main line. It is easier to cap an abandoned line than to remove it. Omission of a sectionalizing valve may shave a few dollars off the cost of a new installation.

Need for proper maintenance of piping systems may also easily be overlooked until trouble breaks out.

Since failure of such systems can produce delays that are just as annoying and costly as those brought about in any other way, there is real need for an occasional thoroughgoing inspection and revamping. Such an inspection should go much farther than a routine check for leaky valves and the like.

It is important that pipe sizes be checked with care. Suitability of the layout for the service, and the condition of all elements in it are worthy of painstaking examination. Simplicity of a system is a decided advantage. Hence, whatever can be done to increase it is usually worth doing. Eliminate all dead-ended and abandoned lines. Wherever corrosion is a problem consider the use of more resistant materials.

In the long run it costs more to neglect piping systems than to keep them up to date.

Grid Distribution Systems Have Features You Want

THE NETWORK SYSTEM of distribution for industrial plants offers important advantages that merit wider recognition than is sometimes accorded. What these advantages are was clearly pointed out by Messrs. Powel and Barnett at the recent winter convention of the AIEE.

It is hardly possible to lay out a system that will serve the needs of all plants with equal efficiency. For one reason or another, however, the majority of plant distribution systems are of the radial type, in which feeders branch out from a substation to the various distribution centers. With such a system failure of a main transformer or faults on primary feeders or secondary circuits are likely to result in serious interruptions unless special measures have been taken to reduce their duration.

Greater reliability of operation is one of the important advantages of the network system of distribution. This feature, which is of the utmost value in many plants, comes about because a network comprises a secondary grid whose junction points are supplied through network transformers and protectors from two or more primary feeders. Since the grid is energized from all the transformers and feeders supplying the plant, outage of a feeder or transformer will not affect operations.

The network system has the further advantage that increases in load or the rearrangement of present loads can be easily handled. When necessary a transformer can be added at a junction point of the grid without interrupting service.

All in all, this system of distribution has much to commend it.

SELECTION • INSTALLATION • INSPECTION • UPKEEP • ORGANIZATION

Keep Fire Out of Air Ducts

Proper installation and upkeep will reduce chances of fire in ducts: suitable protective devices will prevent spreading of smoke and flame from fires in areas served

S. F. TIRRELL

Engineer, Associated Factory Mutual Fire Insurance Companies
Boston

FIRES ARE SERIOUS in air conditioning and ventilating systems because, unless the systems are properly installed and maintained, they may be the means of spreading smoke and fire through all parts of the building. The principal points in making such systems safe are: (1) To use great care in preventing any possibility of fire entering them; (2) to arrange the systems so that smoke and fire can not be carried through them; (3) to use non-combustible material in their construction.

$500,000 Damage

Data compiled from all available sources indicate that during the past five years there were three fires involving air conditioning and ventilating systems, each of which caused damage of more than $500,000. Fortunately there was no loss of life, but in each instance production was badly delayed.

Fires in these systems have been started by sparks from fans; by overheated bearings; spontaneous ignition of oil-saturated filters; defective wiring; and by outside fires being drawn into the duct system. Fuel is provided by dust deposits inside ducts, by flammable vapors in exhaust systems, or by combustible insulating and acoustical linings through which fire can spread rapidly because of air currents. Failure to shut down fans promptly has led to the rapid spread of many fires.

Experience indicates that proper installation and suitable maintenance of air conditioning and ventilating systems are effective ways to lessen the possibility of extensive property damage and safeguard the lives of employees. It is therefore important to arrange these

Stanley F. Tirrell, one of the younger engineers in the inspection department, has twelve years' service to his credit. His early years with the companies were spent inspecting plants all over the country. In this capacity he may have visited your factory. More recently Stan's six feet of geniality has been confined to his desk in the engineering department, preparing and approving layouts of fire protective systems for new construction and special hazards in industrial plants. For relaxation, when he can find the time, he turns to color photography and golf

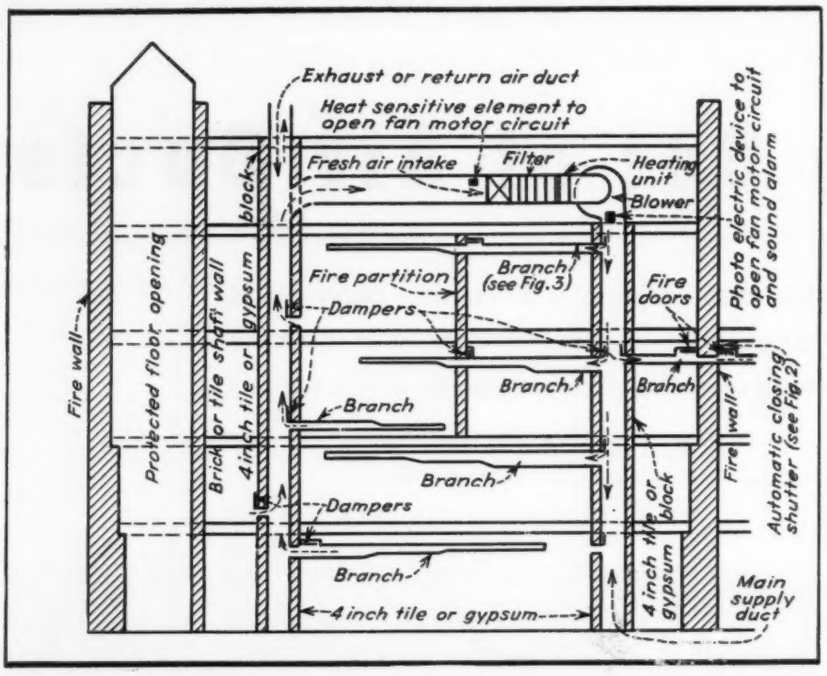


Figure 1. Here is a layout of a typical air conditioning system showing where dampers and the various other protective devices actuated by heat or light should be located

systems so that smoke and fire will not spread through the ducts to areas other than the one in which the fire occurs.

All ducts should be of non-combustible construction, with fire-resistive or non-combustible linings or coverings. Where ducts form part of the building structure, see that the vertical wall construction has a two-hour fire resistance rating. Structural strength and durability at least equal to galvanized sheet iron or steel are required for all ducts, varying from a minimum thickness of 26 U. S. gage for the smallest ducts to as much as 18 gage for the largest. Joints should be riveted or have locked seams.

No openings other than those required for cleaning are necessary. Suitable clean-out openings are recommended at 20-ft. intervals, but grilles in the duct system are often sufficient.

To Reduce Sound Travel

For flexible connections installed to reduce sound travel or vibration, woven asbestos or material of equal fire resistance is advisable.

When installing duct systems, eliminate all spaces around the ducts that would permit the passage of smoke, heat, and possibly fire. See Figure 1. Fill any such spaces at walls, floors, and partitions with mineral wool held in place with metal collars. A covering of ¼-in. asbestos mill board or its equivalent is advisable if ducts are required to pass through combustible concealed spaces.

It is also important that all ducts be provided with substantial supports and that they be located where they will not be subject to mechanical injury. Piping or other equipment should not be supported from them.

When designing air conditioning and ventilating systems, one may well avoid piercing firewalls with distributing ducts. Where it is necessary to do so, however, automatically closed fire doors, Figures 2 and 3, should be installed inside the ducts at both sides of the wall through which the duct passes. Automatic operation may be obtained by locating fusible elements, heat-actuated devices, or photoelectric devices where they will be quickly affected by an abnormal rise in temperature or a slight change in light intensity. The doors should preferably close with the direction of air travel. They should also be so installed that damage to the duct will not interfere with their operation.

Automatic Fire Dampers

Building construction and occupancy will determine whether automatic fire dampers are needed at floor levels. If conditions permit their omission at floor levels, dampers are usually necessary at all inlets and outlets in the main supply and discharge ducts. Dampers in ducts up to 18 inches in width or diameter should be made of 16 U. S. gage metal; those in ducts up to 36 inches of 12 gage, and in ducts of larger size, 7 gage.

Care in selecting the location of the fresh air intake is essential in order to prevent the possibility of an outside fire being drawn into the duct system. If there is any likelihood of fire occurring near an intake use of a damper arranged for automatic operation, preferably with heat-actuated devices, is advisable. The heat-actuated devices can also be arranged to open the fan motor circuit if the fire causes an abnormal rise in temperature.

Select the location of inlet and exhaust air openings carefully, and provide grilles at least on those openings

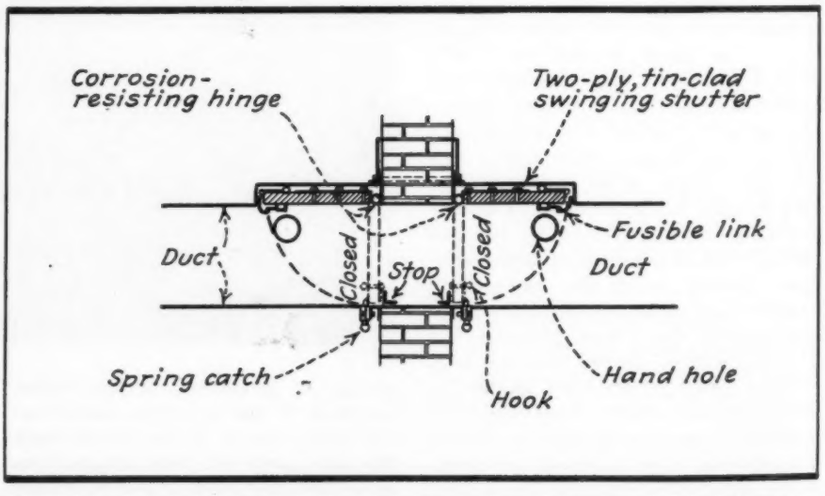


Figure 2. Automatic shutters are installed this way in class A wall (major firewall) openings. In vertical ducts use the same arrangement but only one shutter

that are placed within 7 feet of the floor. Usually it is advisable to keep all openings a few inches above floor level, to prevent rubbish and debris from entering the system.

The air should not be recirculated in areas where flammable vapors or dusts are present.

Several types of filter media are used in unit-type filters. Many units now available are treated with a high-flash-point mineral oil. The type of filter best suited for the conditions depends in part on building occupancy. The smoke-producing characteristics of the various filters in the event of fire is also important. Some types give off little smoke when burning and are therefore particularly well adapted to public buildings such as schools, theaters, hospitals, and libraries, where thick smoke could create panic. In industrial properties use of such filters is advisable if the stock or equipment is susceptible to smoke damage.

Where automatic oil-type or other combustible air filters are used, automatic sprinkler protection should be provided in the filter room if there is a possibility of ignition from the outside or other sources. It may also be advisable to make suitable provisions for draining the oil reservoir.

Access to Outdoors

The best location for fans, filters, washers, heating and cooling equipment is in a room having direct access to the outdoors, and separated from other parts of the building by a partition having a fire-resistance rating of at least one hour. Automatic control arranged to open the fan motor circuit in the event of fire is highly desirable in all types of systems and is particularly well suited to those of the recirculating air type.

Several methods of providing such automatic control are used; the type that is most suitable will depend on various features. In buildings equipped with automatic sprinklers, a control can be installed to shut the fan down when a sprinkler operates. Where this arrangement is not practicable, thermostats or photoelectric devices placed at various strategic locations are to be recommended.

Because of their ability to detect smoke, photoelectric devices (Figure 4) are desirable safeguards. Such units may be arranged to shut down fans, sound alarms, and close dampers. Their effectiveness, however, depends largely on proper installation and adjustment. For satisfactory operation the light source should be a minimum of 12 feet from the phototube, which should always be on the downstream side of the filters. Also, the phototube should be so installed that with the aid of mirrors the light beam will cross the duct at least twice to prevent smoke passing undetected.

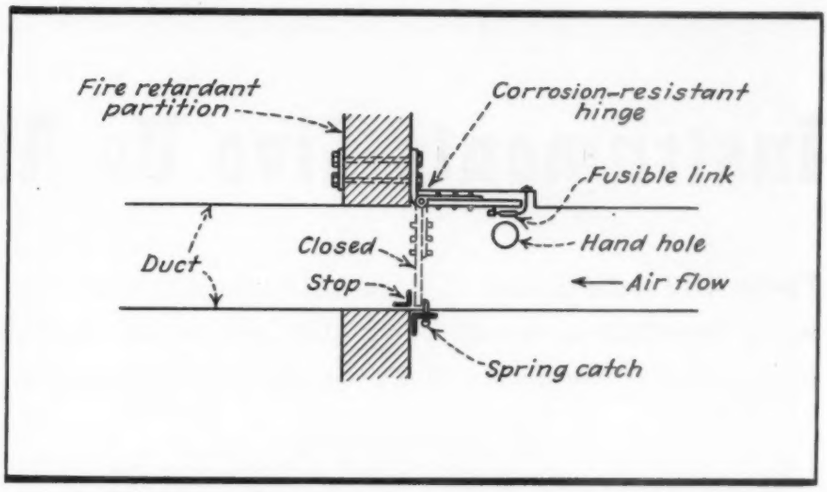
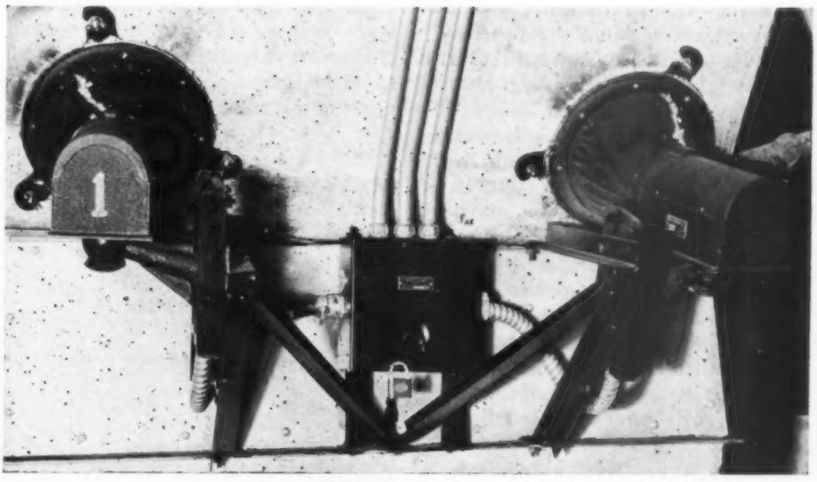


Figure 3. This arrangement of an automatic closing damper is used for class B wall openings. Class B walls embrace fire-resistant partitions having two-hour rating



Photograph by courtesy of American District Telegraph Company

Figure 4. In this installation of a smoke detector on a large duct the light source is at the left. A mirror on the other side reflects light to phototube at the right. Fireproof hoods permit cleaning lenses without entering duct, and damp out vibration

These units are obtainable at nominal cost from several manufacturers. In ordering, the purchaser should specify a unit that operates at 15 percent reduction in light intensity, which is the maximum sensitivity recommended by the manufacturers.

Frequent inspections of all automatic equipment, cooling and heating coils, plenum chambers, filters, and the duct system are highly essential. Accumulations of dust or other combustible material near the intake or in the duct system should be removed immediately. Protective equipment also should be inspected to determine its fitness for operation. Failure obviously can have serious consequences.

Carefully examine unit filters to be certain that the resistance to air flow is not seriously impeded. Renewal or cleaning should not be neglected if the resistance of the filter is five times greater than that for which it was designed.

Electrical equipment and wiring require periodic inspections to make sure that all is in order. Proper lubrication of fan and motor bearings is likewise highly important.

Instruments Give Us All the Facts

That's why some are put to work whenever machines are to be installed or tested, or trouble breaks out, while others keep a continuous check on equipment operation

W. L. GEORGEN

Plant Engineer, Indianapolis Works, International Harvester Company Indianapolis

PREDETERMINE electrical conditions by testing with instruments when the equipment or machines are installed." This is a condensed statement of the policy we follow in using instruments.

As any plant engineer knows, adhering scrupulously to this policy saves a great deal of time and electrical trouble. It means that our electricians have to go into a department with test instruments only when trouble breaks out, and that trouble occurs far less frequently than it otherwise would. Moreover, the electrical department takes pride in the fact that more often than not when its men are called in the subsequent testing discloses that nothing is wrong with any power equipment.

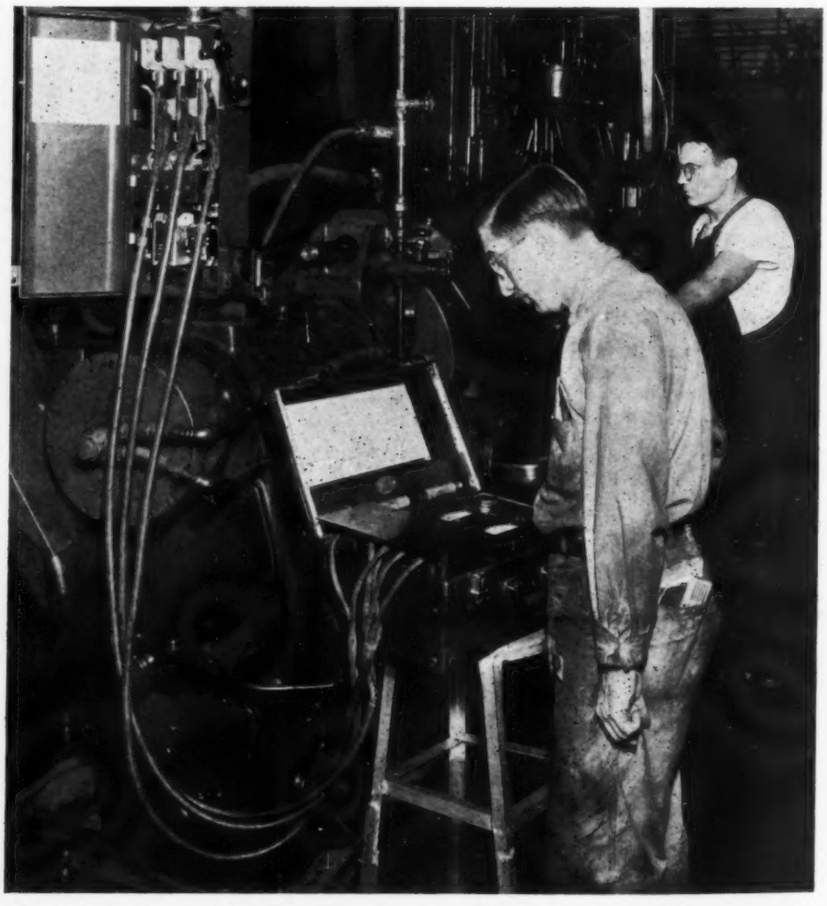
Production Off 25 Percent

For example, one of the departments found its production falling about 25 per cent short of its scheduled output and reported that it could not get the necessary volume of work through a certain power-driven conveyor. The thought was, of course, that the conveyor was not fast enough to carry the work through at the required rate. The electricians could find no trouble.

In order to make a thorough check, however, they attached a recording wattmeter to the conveyor drive motor. Next day they showed the chart to the foreman of the production department and from the facts it disclosed he was able thereafter to bring the output up to full schedule. From the wattmeter chart it was clear that the conveyor was running without load about 25 per cent of the day. The solution of the problem was found by the foreman in a rearrangement of the flow of material.

Another instance where meters did good detective work involved the castings cooling conveyor, an overhead chain that is powered by two motors supplied from a single generator. Both motors supposedly carry identical loads, but last winter one began to take more than its share. Conveyor rollers were being broken and corners pulled out of line. Suspicion, of course, fell upon the motor that was not carrying its half of the load.

To check these motors we purchased two recording universal voltmeters and two recording ammeters. We put a pair of these on each conveyor drive motor. Then, by comparing the charts for any given instant we were able to read off the variations in the load. The instruments showed that the motors were in good condition and performing properly. Nor was anything wrong with any of the electrical equipment. Since



The 10-hp. motor on this lathe gets a check-up, to make sure everything is all right

Socket-type ammeters, upper left, enable operators of sand mullers to get maximum output continuously without overloading the motors

we had gone all the way back to the prime mover and proceeded from there step by step to eliminate the electrical parts from suspicion, the trouble was obviously mechanical. After the electrical equipment had been definitely exonerated several mechanical modifications corrected the difficulty.

Occasionally an electrical instrument is used to make sure that a machine is operated under proper conditions. For example, in the foundry we operate three large sand mullers. When these machines were installed the operator was unable to attain the expected production with the recommended charge, and therefore increased the charge. This overload presently roasted out a motor, and broke two sets of expensive gears.

Eventually a different operating method was demonstrated by the maker after the equipment had been modified and it produced the specified output of sand, using the recommended charge.

To make sure that no further trouble would arise from overcharging the mullers, we installed a socket-type ammeter directly above the charging control apparatus on each machine. For the numerical dial we substituted a dial with the safe load range indicated in green and the danger zone in red, meaning a heavier load than the motor can safely carry. Actually, the limit was set at the full-load current of the motor plus 10 per cent. The green zone goes up to 100 amperes, for the 75-hp. motor. The increase over full-load rating was justified since the motor drives an intermittent load.

The operator was instructed to watch the instrument while he dumps in the charge from the overhead hopper and to shut off the flow before the indicator hand reaches the red zone. As a result there has been no electrical or mechanical breakdown since the ammeters were installed, and production is maintained at the scheduled rate.

Extensive use is also made of switchboard-type meters on the main and substation panelboards. We duplicate the public utility's metering on the main panel, using cubicle types of switchgear with oil circuit breakers below and instruments above. On the main panel there is also a power factor meter. With it we can easily take a reading on any circuit on the board. There is also an ammeter on each line.

Only A Few Moments

The same general type of instrumentation is used on each circuit in each of the five substations in the plant. Whenever trouble shows up on any circuit, it takes only a few moments to get the readings we need. The panelboard installations thus eliminate a good many occasions when otherwise we should need to use portable instruments.

Almost without exception each portable electrical instrument in our rather sizable stock was purchased for a specific, usually routine, type of testing. If it is an instrument that is widely applicable and in great demand we usually buy one for the machine shop and one for the foundry. After we have the instrument we usually find some special application for it that was not foreseen, but which repays the original cost.

A prize instance is afforded by our cathode ray oscillograph.

In the boiler house we have two boiler control panels which are synchronized with a master motor and a receiver motor on the draft coal feed, making it possible for both boilers to operate on the line together. It was pure guesswork when we tried to synchronize these two motors, once they got out of step, until the electrical department worked out a solution.

The oscillograph was connected to the two motors so that the sending or master motor registered on the vertical plane and the receiver on the horizontal plane. Then as the two motors were moved in and out of step it was possible to see the two distinct wave forms on the screen of the instrument. Hence it is a simple matter to adjust the relative positions accurately.

All told, we use more than 30 portable electrical instruments regularly in our electrical department, plus a far larger number that are permanently installed. The specific, positive information that is indispensable for keeping production and power equipment in the best operating condition is obtained from these instruments, which are its only possible source. It is difficult to believe that any such complex industrial organism as our plant could possibly meet today's high-precision, mass-production requirements if such accurate up-to-the-minute facts were not continuously available.

Can This Motor Be Slowed Down?

Concluding a discussion on types of motors whose speed can be reduced, with the methods used for this purpose

R. F. EMERSON

Industrial Department, General Electric Company

Schenectady, N. Y.

SPEED-LOAD characteristics of single- and two-speed squirrel-cage, wound-rotor, and shunt and series-wound d.c. motors were discussed in the February issue from the standpoint of the ease with which speed can be reduced and of accuracy of speed control.

Figure 1 shows a number of combinations of various percentages of resistances that were calculated for a 100-hp. series-wound motor having the basic speed-load characteristic shown in curve *A*. By definition 100 percent resistance is found by dividing applied volts by full-load current.

Curves in Figure 1 show the result of increasing and decreasing resistance in both multiple and series with the motor. For example, curves *D* and *E* with 100 per cent resistance in series have approximately 100 percent torque at zero speed, but by cutting resistance in half we get about twice the amount of load. On the other hand, curves *C* and *E* represent performance when there are 100 per cent ohms in multiple with the armature, but when this resistance is reduced by 50 percent the speed is materially reduced at zero load.

Compound-Wound D.C. Motors

The speed-load curve of a compound-wound d.c. motor is shown in Figure 2, together with typical curves of shunt and series motors. The same comments could be made in regard to the compound-wound motor as made regarding shunt and series motors, except that speed regulation of its basic speed-load curve is not so good as with the shunt motor, although better than that of the series motor. Regulation is affected by the relative strengths of the shunt and series portions of the compound winding of this type of motor.

Variable-Voltage System

Extremely good speed regulation and very low speeds are obtainable by the use of variable-voltage (Ward-Leonard) control. This system is shown schematically in Figure 3 and consists of a d.c. shunt-wound motor M_2 driving the load. This motor is supplied from a d.c. variable-voltage generator *G*, which in turn is driven by a constant-speed synchronous or induction motor M_1, or by any other available prime mover.

There is also required a source of constant voltage for excitation which is usually a direct-connected exciter used on the motor-generator set. By varying the field strength of the d.c. generator,

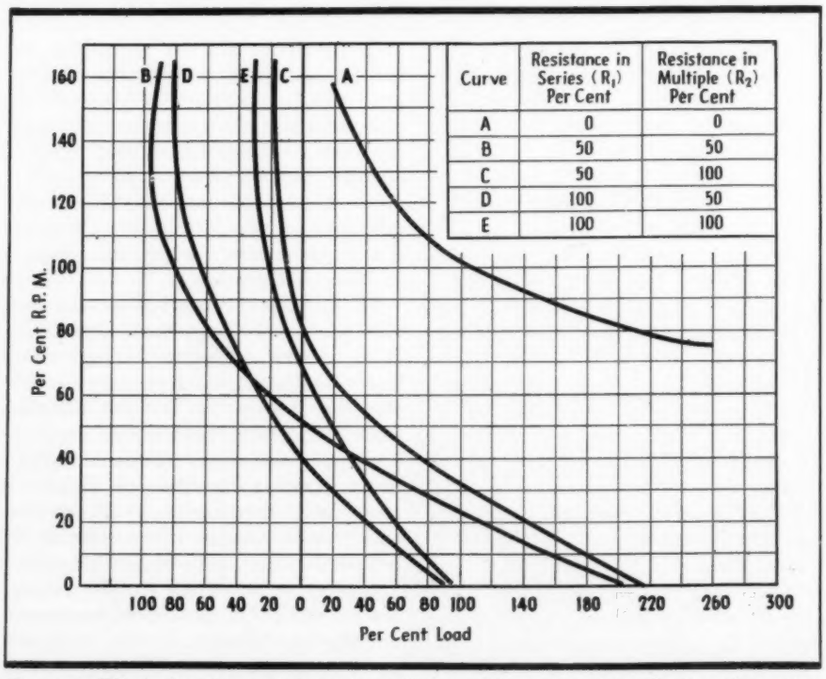

Curve | Resistance in Series (R_1) Per Cent | Resistance in Multiple (R_2) Per Cent
A | 0 | 0
B | 50 | 50
C | 50 | 100
D | 100 | 50
E | 100 | 100
B
D
E
C
A
Per Cent R.P.M.
0 20 40 60 80 100 120 140 160
100 80 60 40 20 0 20 40 60 80 100 140 180 220 260 300
Per Cent Load

Figure 1. Effect of putting resistance in multiple and in series with a large series motor

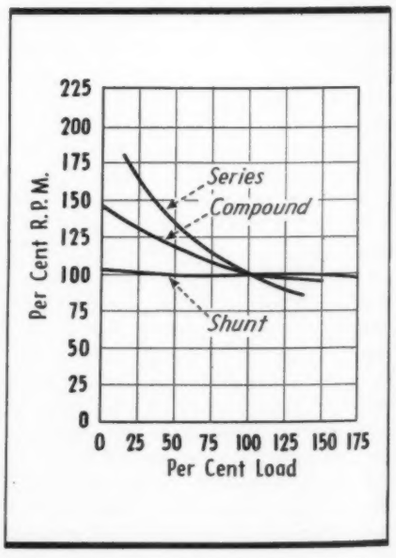
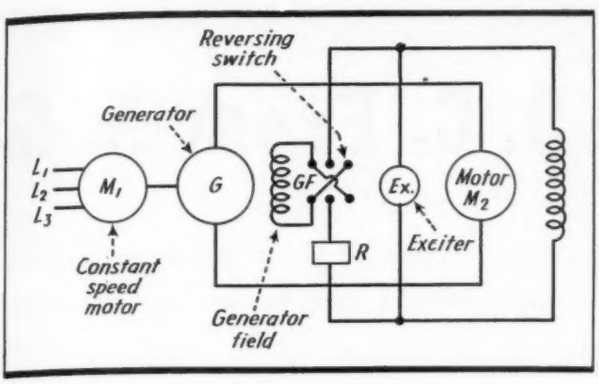


Figure 2. Speed-load curves of typical compound, shunt, and series-wound motors



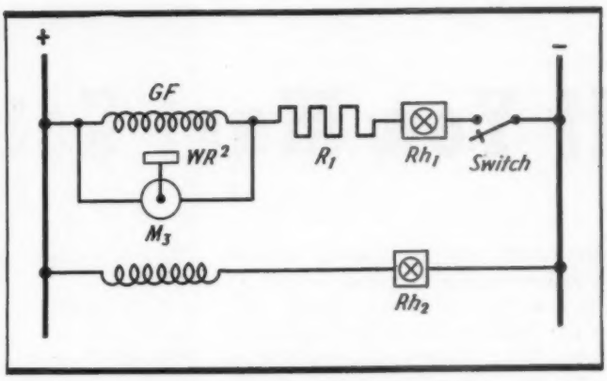


Figure 3. (Above). In variable-voltage systems load is driven by a shunt motor supplied by a variable-voltage generator. Speed of the shunt motor is adjusted by varying field strength of generator

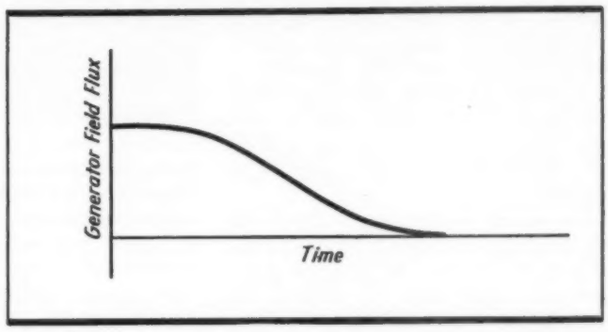


Figure 4. (Upper right). A small shunt motor, M_3, insures smooth, easy acceleration and retardation. When excitation is removed the field is excited momentarily by this motor, running as a generator

Figure 5. (Right). With a properly designed variable-voltage system starting and stopping are very smooth, as indicated by this curve showing the gradual rate of decrease in field strength

a multiplicity of speed-load curves are obtained.

Reversing the polarity of the field of the variable-voltage generator reverses the direction of rotation of the d.c. motor.

Good speed regulation is obtained for either a motoring or an overhauling load. Since increase and decrease in speed are functions of the build-up of the generator field, the variable-voltage system has the additional advantage of providing a smooth rate of acceleration and retardation. This is of advantage where people are being handled in an elevator or tramway.

In one application a conveyor handling pots of molten metal had to be started and stopped frequently without causing ripples on the surface of the metal which would spoil the product. The system of control proved satisfactory. Another conveyor handling airplane parts was required to stop at a certain spot under a press where operations were performed on the parts. Smooth starting and stopping were also required in order not to disarrange these parts on the conveyor. Again the same type of control was used successfully.

Smoothness of both acceleration and retardation with this type of control is worthy of further discussion. Figure 4 shows the generator field taken from Figure 3. Increase and decrease of the speed of motor M_2 in Figure 3 is initiated by varying the strength of field *GF* of the variable-voltage, constant-speed generator. Speed of the motor follows closely changes in *GF* field strength. Motor M_2 is a shunt-wound, separately excited machine of a capacity corresponding to the maximum field current of generator field *GF*. It is, therefore, small compared with the other rotating units and is often in the neighborhood of fractional-horsepower size. This motor, M_3, is usually equipped with a flywheel in order to extend the time of its acceleration and retardation by the desired amount, and also to insure proper relations between its stored energy and maximum steady state and the energy stored magnetically in field *GF*. A series resistance R_1 insures that *GF* is excited at a certain voltage less than full exciter voltage.

Assume that motor M_2 in Figure 3 is running at top speed and *GF* is receiving 100 percent excitation from *Ex*. To reduce the rotation of M_2 to a creeping speed it is only necessary to reduce the excitation of generator field *GF* to a very low value, which is done by increasing the resistance in RH_1 to a relatively high value. This increase can be applied in one step since the time of retardation is governed by the time it takes M_2 to coast nearly to rest.

When the excitation derived from *Ex* is nearly removed from *GF*, the latter initially continues to receive practically 100 percent excitation from M_3, which is now running as a generator and delivering its load current to *GF*. The initial counter-emf. of M_3 is clearly equal to the *IR* drop of *GF*, and, if the component parts of the various devices are properly designed, the excitation of *GF* declines smoothly to the required low value. And, of course, the rate of speed decline of M_2 is governed accordingly.

The smoothness of the retardation obtainable in this manner is indicated in Figure 5. This curve shows a very gradual decrease in field flux with smooth starting and stopping. It will be noted that the greatest speed change takes place when the change is half completed, which is ideal.

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If You Must Get D. C. From A. C.

Since there are three types of conversion equipment, each having its advantages and limitations, selecting the one best suited requires study of several factors

W. R. HARRIS

Industrial Engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh

INDUSTRIAL PLANTS almost without exception require a certain amount of direct current, although it may only be the power required for a magnetic clutch, the excitation of a synchronous motor, or a few watts for some control circuit. On the other hand steel mills, electrochemical plants, and various other industries use large amounts of d.c. power. To obtain direct current a conversion device usually must be used, since almost all modern power systems are designed to supply alternating current.

Conversion devices may be most simply regarded as links between an a.c. system and a load that requires direct current. They may be divided into three basic classes: (1) those that perform the conversion by means of rotating machines; (2) those that mechanically make and break the circuit so that the output current is unidirectional; (3) and those with the characteristic of asymmetric resistance, so that current is passed freely in one direction, with difficulty in the other.

The modern family of commercial conversion devices has members in each of these classes. In the first class are motor-generator sets and the synchronous converter; in the second class are vibrating and commutating mechanical rectifiers; and in the third class the copper oxide rectifier,

Comparative Characteristics of Different Types of Conversion Devices

Type of Device	*Advantages*	*Disadvantages*
Motor-generator set	Voltage regulation simple and inexpensive. Offers power factor correction when synchronous motor is used. Direct current output independent of a.c. supply. Low cost in most cases	Needs clean air for cooling. Over-all efficiency comparatively low. Requires large starting current in some instances. Subject to current-collecting problems. Requires heavy foundations. Noise level relatively high. Cost of brush replacement
Synchronous converter	Comparatively high efficiency at 250 volts. Cost lower than rectifier at 250 volts. Operates satisfactorily with extreme unbalance of load on three-wire circuits. Power factor high	Needs clean air for cooling. Subject to current-collecting problems. Heavy foundations needed. Creates some noise. Cost of brushes. Polarity may require reversing after starting. Voltage regulation expensive. Direct current output dependent on a.c. supply
Mercury arc rectifier (tank type)	Static device. Water cooled. Resists corrosion. Indefinite life. Light weight compared to rotating equipment. Simple to operate. High efficiency at full and light loads. High momentary overload capacity. Low maintenance. Quiet operation	Power factor depends on amount of grid control used. Initial cost high. Direct current output dependent on a.c. supply. Water supply, or a water-to-air heat exchanger required for cooling
Mechanical rectifier		Inefficient. Noisy. May cause radio and telephone interference. High maintenance. Requires frequent adjustment. Short life
Electronic tube rectifiers	Suitable for very small power requirements. Three- and four-element types offer advantages in circuit control not possible with other devices. Large number of types available. Applicable to special requirements. Static device	Inefficient at low voltages. Require periodic replacement
Copper oxide rectifiers	Static device. Light in weight. Indefinite life. Low maintenance. High momentary overload capacity. Compact. High power factor. Low installation cost. Quiet operation	Voltage regulation not so good as with other other types. Slight loss in efficiency with age. Direct current output dependent on a.c. supply
Ignitron	See under Mercury Arc rectifier for general advantages. Ignitron is slightly more efficient; more flexible in application; better suited for medium power output	Power factor depends on reduction of voltage below normal. Direct-current output dependent on a.c. supply. Water supply required for cooling

A Virginian by birth, W. R. Harris got his formal education in electrical engineering at West Virginia University, where he was graduated in 1937. He joined Westinghouse the same year and after spending a short time in the graduate student training course started his career as an industrial engineer. He's versatile; helped earn his way through school by doubling on saxophone and clarinet in dance bands, and by working as an electrician in coal mines

single- and multi-anode mercury arc rectifiers, and hot cathode electronic tubes. Advantages and disadvantages of each type are summarized in the table on the facing page.

The motor-generator consists of an a.c. motor driving a d.c. generator. Transformers are not usually required since the motor can be wound for voltages up to 13.2 kilovolts. Motors of sets rated from, say, 1 to 50 kilowatts usually are of the induction type, whereas those of 50-kw. rating and above are of the synchronous type, although practically any rating can be furnished in either type.

Where system power factor correction is desired the synchronous motor-generator set is useful, since the 80 per cent power factor motor delivers leading reactive kilovolt-amperes equal to 60 per cent of its full-load rating. When the motor field is adjusted to give 80 per cent leading power factor at full load, it is over-excited at light loads and delivers a larger amount of reactive kilovolt-amperes than at full load. This characteristic is decidedly advantageous.

Direct current output is entirely independent of the a.c. supply to a motor-generator set; consequently voltage regulation and adjustment are very simple and inexpensive. By separately exciting the d.c. generator stable voltages can be obtained over extremely wide ranges—a feat that is not easily or economically duplicated with other types of conversion devices.

Efficiency of the motor-generator set is comparatively low because of the electrical - to - mechanical - to - electrical power conversions and the rotational losses of two machines, as will be seen from Figure 1. Starting current of the motor is large and in many cases it is necessary to take special precautions to limit it, since it may be as high as six times full-load value. Momentary overload capacity is determined by commutation limits and the ability of the driving motor to stay in step, and hence is limited to 200 per cent or less.

Brushes require replacement at infrequent intervals and the bearings and current-collecting parts require periodic maintenance for trouble-free operation and long life. Noise caused by windage and brush friction is objectionable, although in most locations it has little significance.

The theory of a synchronous converter can be best explained by its similarity to the synchronous motor-generator set. A converter combines the characteristics of both motor and generator in a single armature winding. This winding is provided on one end with a commutator as in a d.c. generator, and on the other end with collector rings as on a revolving-armature synchronous motor. Alternating current is supplied through the collector rings and direct current is taken out at the commutator end. A complete installation consists of transformers, synchronous converter, and switchgear.

Voltage output of the synchronous converter is a direct function of the impressed alternating voltage, the ratio being dependent on the number of phases and the relative points in the winding to which the brushes and the collector rings are connected. Consequently, fluctuations in supply voltage are directly reflected in the d.c. output. Changes in output voltage, are usually accomplished by a booster or by changing transformer taps.

Since the change from alternating to direct current is accomplished electrically, the synchronous converter is more efficient than the motor-generator set. At 250 volts it compares favorably with the mercury arc rectifier, Figure 2, but at higher voltages the rectifier is more efficient (see Figure 1). The synchronous converter with its transformer operates at a trifle under unity power factor. Although it does not deliver any leading reactive kilovolt-amperes, its power factor is so high that when combined with a low power factor load the over-all power factor is raised.

Overload capacity of the converter is determined by commutation limits on the d.c. end, and 200 percent momentary load is the maximum unless the unit is derated. Brushes, commutator, collector rings, and bearings require maintenance similar to that of a d.c. machine of like size.

Starts Like a Motor

A synchronous converter is usually started like a synchronous motor. Commutation is bad during the period when the starting current is high unless the brushes are lifted from the commutator. Special means are provided for this purpose. Polarity must be checked, and reversed if necessary, after the machine has reached operating speed.

Synchronous converters can be used to supply three-wire circuits without structural changes, and will operate satisfactorily with extreme differences of current in the outside leads. Noise caused by windage and brush friction may be somewhat objectionable in isolated instances.

The cost of a synchronous converter with transformers and switchgear is approximately the same as that of an equivalent motor-generator set.

By opening and closing a circuit in synchronism with an applied alternat-

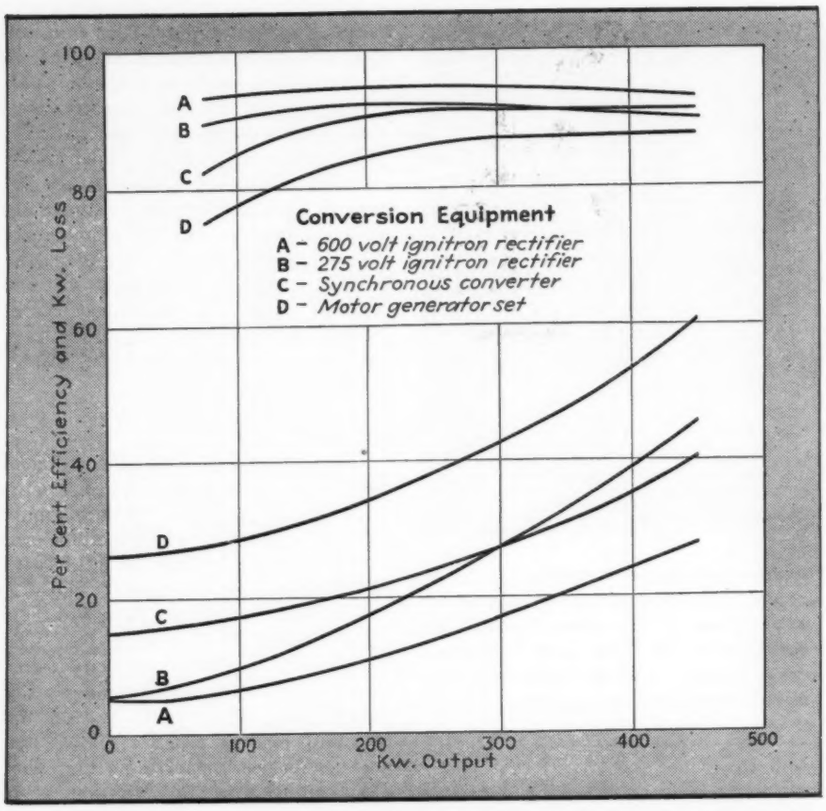


Figure 1. These curves show the efficiency and losses of three types of conversion equipment, all rated 300 kilowatts, when operated under different percentages of load

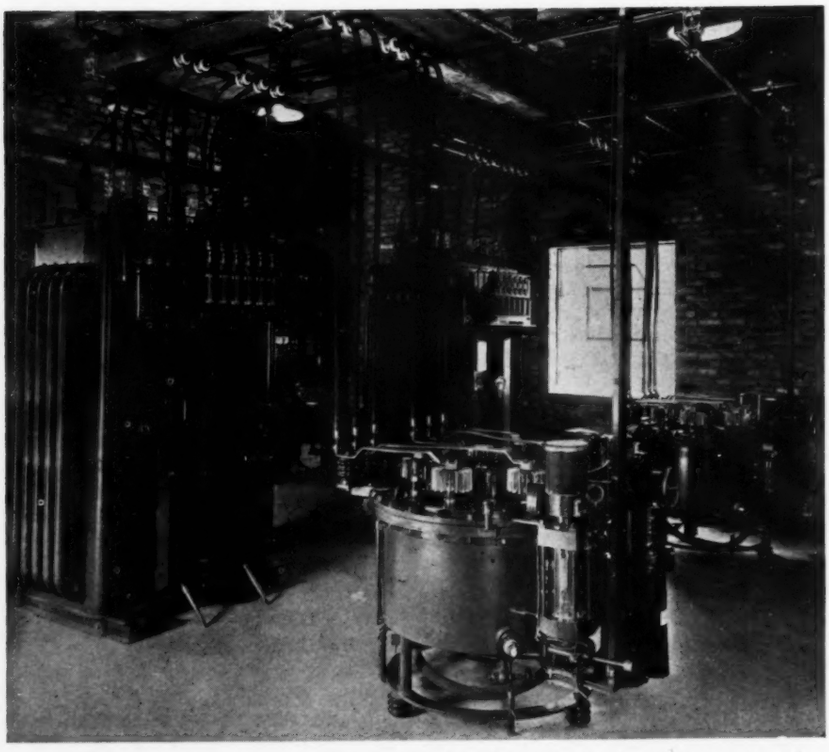


Figure 2. The two tank-type mercury arc rectifiers shown in the foreground and at the right are rated 200 kilowatts each, supply direct current to a large printing plant

ing potential it is possible to rectify current by mechanical means. Vibrating devices have been used for supplying small amounts of power at low voltage, such as small battery chargers. A rotating commutator machine is sometimes employed for supplying potentials as high as 75,000 volts for smoke precipitation equipment.

Mechanical rectifiers in general are inefficient, noisy, and may cause radio and telephone interference. The vibrating or rotating parts require frequent adjustment and maintenance, and the current-carrying contacts are subject to sparking and require frequent attention. This type of rectifier, which has only limited capacity, has been supplanted by the more modern types, such as the electronic tube and the copper oxide rectifier.

Only One-Way Traffic

Electronic tube rectifiers may be of either the high-vacuum or the gas-filled types. Both operate on essentially the same principle, employing an anode and a heated cathode (which serves as a source of electrons) sealed in a glass tube. Since the anode cannot emit electrons, conductivity is in one direction only and the tube forms a satisfactory rectifier or valve. Certain types of tubes are provided with control grids. In high-vacuum tubes these grids have complete control over the current but in the gas-filled type they are able only to start, not stop, current flow.

Application of the electronic tube in industry has been slow because of the mystery which surrounds it in the minds of the layman and the engineer who has not had direct experience with tube problems and circuits. Strangeness of terms and the unreality of radio have added to this mystery.

Electronic tube rectifiers are available over a considerable range of current, voltage, and power ratings. In general, high-vacuum tubes are used for supplying small currents at high voltages, while gas-filled tubes can handle heavier currents at low or high voltages. The relatively low efficiency of these tubes at low voltage and the necessity of periodic replacement have limited their general application as power rectifiers for industrial use, with the exception of mercury arc rectifiers and ignitron tubes, which are in reality husky electronic tubes with long life.

Life factor of electronic tubes is being extended, however, by modern design and manufacturing methods and as engineers become more familiar with them their application will become more general.

(Continued in April)

Maintenance Service Shorts

Readers are invited to contribute brief illustrated articles reporting out-of-the ordinary maintenance accomplishments. Accepted articles will be paid for

ELECTRICAL UTILIZATION

Loose V-Belts Cause Hunting of Synchronous Motor

LIONEL A. HUNT, *Assistant Factory Superintendent*
English Electric Co. of Canada, Ltd. St. Catharines, Ont., Canada

A synchronous motor that had recently been installed to drive a compressor through V-belts suddenly developed a tendency to hunt, which daily became more pronounced. The consulting engineer on the job believed that the trouble was of electrical origin, and suggested that certain changes be made in the damper winding.

All theories about the possible causes and cures of the trouble collapsed, however, when it was found upon examination that the V-belts had unusual elasticity and were too slack. On the compression stroke the belts tightened on the under side of the drive, and stretched. An instant later, on the second part of the load cycle, they were relieved momentarily of the stress, and returned to normal. This oscillating-spring effect of the belts resulted in hunting of the motor. It was easily overcome merely by tightening the new belts until they took on a permanent stretch.

•

Reduced Plastic Breakage in Tumbling Barrels 70 Percent

SOURCE

R. W. Cramer Co., Centerbrook, Conn.

Breakage of plastic parts while being tumbled to remove the flash has always been a problem to manufacturers that have much of this work to be done.

One large concern, in an endeavor to overcome breakage, made a thorough investigation of barrel tumbling operations and found that there was a "critical time period." If this time was exceeded, the main piece of molding would start to check, crack, and break.

In this particular operation, the tumbling action was used primarily to break off small fins and other surplus flash material from the molded parts. Parts were placed in the barrel with soapy water and small wooden cubes and marbles which had a tendency to polish them as well as to remove surplus material.

When the exact time had been ascertained, the company had a large panelboard designed upon which were mounted six electrical time-controlling switches capable of serving the large number of tumbling barrels used on this job. Each of these timers is set when the respective barrel was put into operation, automatically "throws off" and stops the operation when that barrel reaches the critical period. The control board was designed to enable the operator of any tumbling barrel to "plug in" on the "not busy" timers when he started operations.

By this method, the plastic manufacturer was able to eliminate approximately 70 percent of the breakage.

BUILDINGS, SERVICES, MAINTENANCE

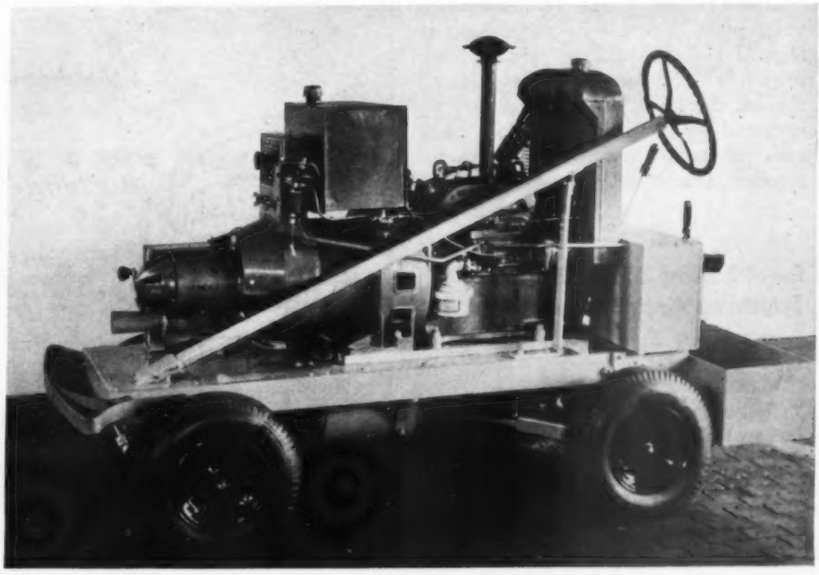
This Welder Goes to the Job at 8 M.P.H.

SOURCE

Lincoln Electric Company, Cleveland

A self-propelled engine-driven welder made recently by the Precision Engineering & Manufacturing Company of New Philadelphia, Ohio, has steering gear, forward and reverse speed controls with throttle, a treadle braking system similar to that used on electric mules, balloon tires, and a platform in which the operator stands.

This equipment cost approximately $600 and was largely made from rebuilt Ford parts. The motor is a 3-hp. traction motor 85 volts d.c. for mine use. A safety switch beside the exciter is used for welding or propulsion so that both cannot be done at the same time. When the safety switch is in the running position, the current from the welder terminals is directly connected to the motor and reversing switch. The exciting circuit is broken and a limit switch of the normally off type is inserted in this circuit with a discharge resistance across it. This limit switch



Two self-propelled welders go to job, are saving a chemical plant 8 man-hours per day

is actuated by the brake release pedal. The start is gradual and entirely without jerk. No resistance is used for starting purposes. Speed is controlled by the throttle on the engine. The throttle has a spring so that, if for any reason the driver should slip, the power would be shut off.

The unit has been in use for several months in a large chemical plant which has some 25 electric-drive welders in widely scattered locations, but there are still plenty of places within a two-mile radius of the welding shop that do not have power. Two units of the self-propelled type are now in service, and it is estimated that each unit saves 4 man-hours per day over the former method which was to drag or truck an electric-drive machine and string maybe 500 feet of cable to the job. The welding generator and gasoline engine comprise a standard-model engine-driven welder.

•

Make certain that overhead crane operators anchor their cranes when leaving them unattended. Out-of-door cranes may be swept off their rails by high winds if they are not properly secured.

•

Hose Makes Shock-Absorbing Grip for Hand Tools

H. C. SLEMAN, *New York*

Repeated shocks experienced when holding star drills, chisels, and similar masonry-cutting tools are both tiring and nerve racking.

These effects can be minimized if a short piece of ordinary water hose is slipped over the tool to form a hand grip. In addition to damping out shocks, the hose affords a better grip on small-diameter tools and does away with the possibility of the fingers becoming cramped.

•

Steel Ball in End of Screw Improves Gear Puller

EDGAR WALKER, *Milwaukee, Wis.*

When using the ordinary gear puller having a sharp-pointed screw the latter frequently causes trouble. Sometimes the point will become flattened, thus making it difficult to turn the screw. Again, the point will dig into the shaft and tend to stick.

Those who have experienced such troubles can easily overcome them by inserting the hard steel ball from an old ball bearing in the end of the screw. To do this it is merely necessary to square the end of the screw and drill in it a hole large enough to accommodate a ball of suitable size. The hole should be somewhat deeper than half the diameter of the ball. After the ball has been inserted it can be held in place by peening over the edges of the hole.

If it becomes necessary to use the puller on a shaft whose end has not been center-drilled, put a heavy center punch mark in the end and place the ball against this mark.

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Emergency Bushings for Worn Motor Shafts

JACK BEATER, *Fort Myers, Fla.*

It is often necessary to make quick repairs to a motor whose shaft has become badly worn or scored on the bearing surface. If the trouble happens to be at the stub end the shaft can be turned to a smaller diameter and used with an undersized bearing. Usually, however, the worn journal is at the drive end of the motor or machine and cutting the shaft down makes complications, because pulleys or couplings must then be bushed to fit the smaller diameter.

The method shown in the illustration has proved to be very satisfactory when the shaft on small motors has been cut not more than 0.02 or 0.03 deep. Either the old bushing or a new one of standard size is well tinned on the outside and then given a heavy layer of solder to increase the diameter. It is then split lengthwise on one side with a hacksaw. Two or more blades may be used if it is necessary to compress the bushing that much in order to make it fit the worn shaft. If acid flux is used in soldering, be sure to remove all traces of it. Also, bevel the outer edge of the bushing slightly.

The split bushing is then forced over the shaft until it seats in the worn portion. Pressing the bearing housing over the bushing will cause it to shrink enough to fit both the shaft and the housing. Surplus solder is automatically sheared off as the housing moves across the bushing. A repair of this kind often results in a very tight fit, but if the bearing heats up as the motor is run in the solder will melt enough to loosen the fit on the shaft by allowing the bushing to open slightly because of the natural spring of the metal.

Any oil ducts that are cut on the inner surface of the bushing will be left intact.

This procedure is not, of course, the ideal way to fit or install bearings, but it is a quick method of restoring service in emergencies. Several motors in a packing house that were repaired in this manner about three years ago are still running satisfactorily.

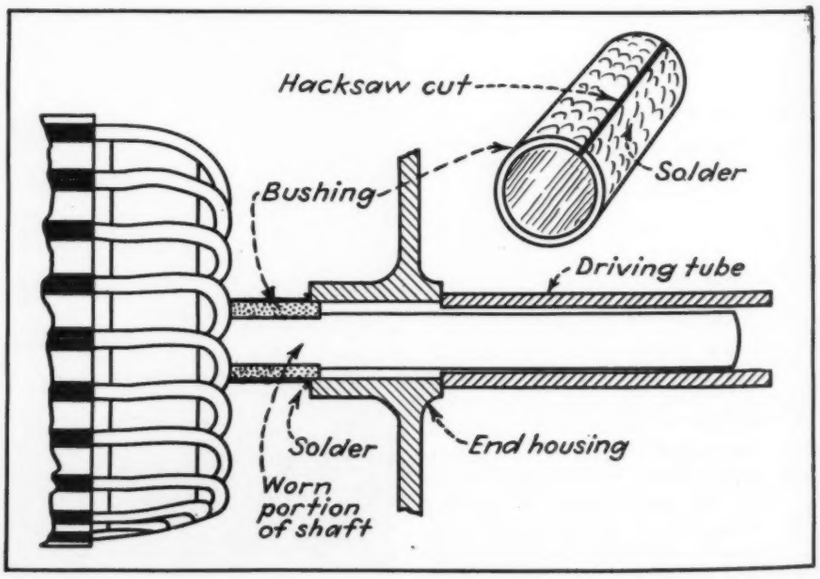
•

Dry Ice Cleans Out Drilled Wells

S. H. COLEMAN, *Roanoke, Va.*

For many years the usual method of cleaning drilled wells has been to explode dynamite charges in them. Use of this method involves a number of hazards that endanger persons doing the work, also the well and its casing.

Recently a new technique that makes



A split bushing is seated in worn portion of shaft, and the housing is forced over it

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Exide Batteries of Canada, Limited, Toronto

use of solidified carbon dioxide has been developed. Not only does it eliminate most of the danger, but it also does a more thorough job of cleaning.

To clean a well the new way about 50 pounds of solidified carbon dioxide (dry ice) is crushed to egg size and dropped into the bore, in order to carbonate the water. After this initial charge has evaporated and the water has dissolved all the carbon dioxide it will hold, a larger amount of dry ice is dropped in. The amount will range from 150 to 300 pounds, depending on the diameter and depth of the well.

The dry ice drops to the bottom of the hole and in evaporating gives off gas so rapidly that water and muck are blown out the top of the casing with considerable force. At the same time the gas penetrates into all the crevices and seams in the rock strata at the bottom of the well. After the first blow relieves the pressure, the water closes over the dry ice again, and the process is repeated until all the ice has evaporated.

•

Portable tool cables kept breaking from continual bending. Each cord was equipped with a 1-ft. sheath of BX cable, attached to the tool holder, and the trouble ended.

•

Oxyacetylene Flame Helps to Straighten Bent Shafts

SOURCE
The Linde Air Products Company
New York

Heat of the oxyacetylene flame can be used to advantage in several convenient methods of bringing a bent or warped shaft back into alignment.

A common procedure is to mount the defective shaft in a lathe and rotate it in order to find the bent section. When it has been located, the outside of the bend is placed at the bottom and heated with a blowpipe to a visible red. As shown in Figure 1, pressure is then applied to the heated area with a crowbar blocked up on the lathe bed, to force the warped section back into line. Repeat this procedure if necessary until the shaft is perfectly true.

By an altenate method the warped area is determined in the same manner as described. After measuring the amount of bend, a pair of wedges, Figure 2, of the correct size are driven between the outside of the bend and the lathe bed. The shaft is then heated at the inside of the bend so that the stress set up by the wedges will force the shaft back into alignment. Repetition of these steps may be necessary to correct excessive misalignment.

If the shaft is too long to be set up in a lathe it may be left in the hangers, as in Figure 3. After checking the hanger bearings to determine the amount of play or lost motion, firmness, and rigidity, a measuring fixture is set up to measure the amount of bend. The high spot is then heated with the blowpipe and by means of a jack forced downward a little more than one-half the total amount of throw, as measured by the dial indicator.

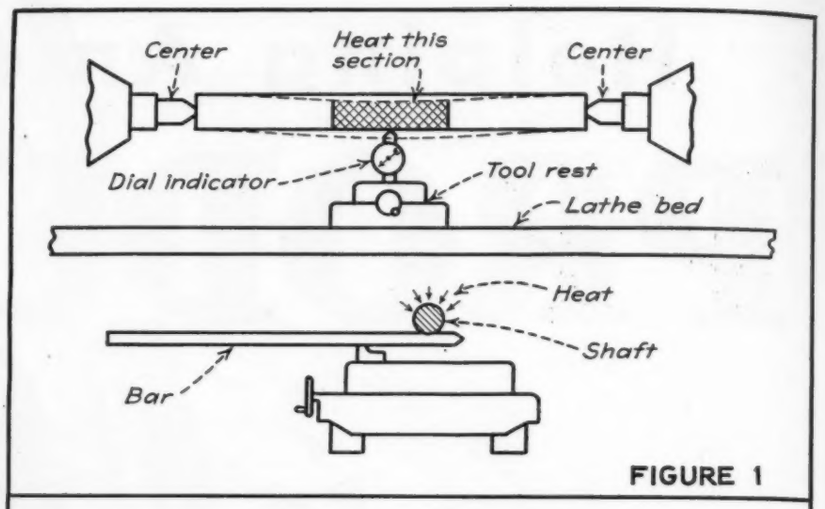


FIGURE 1

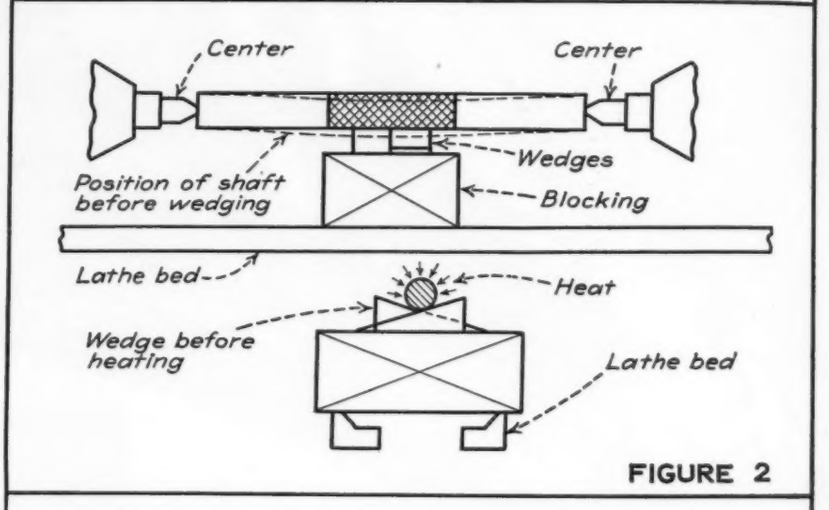


FIGURE 2

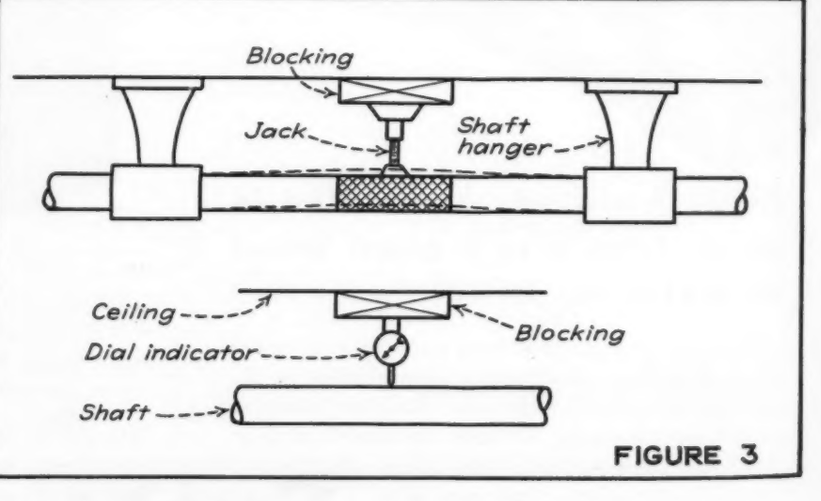
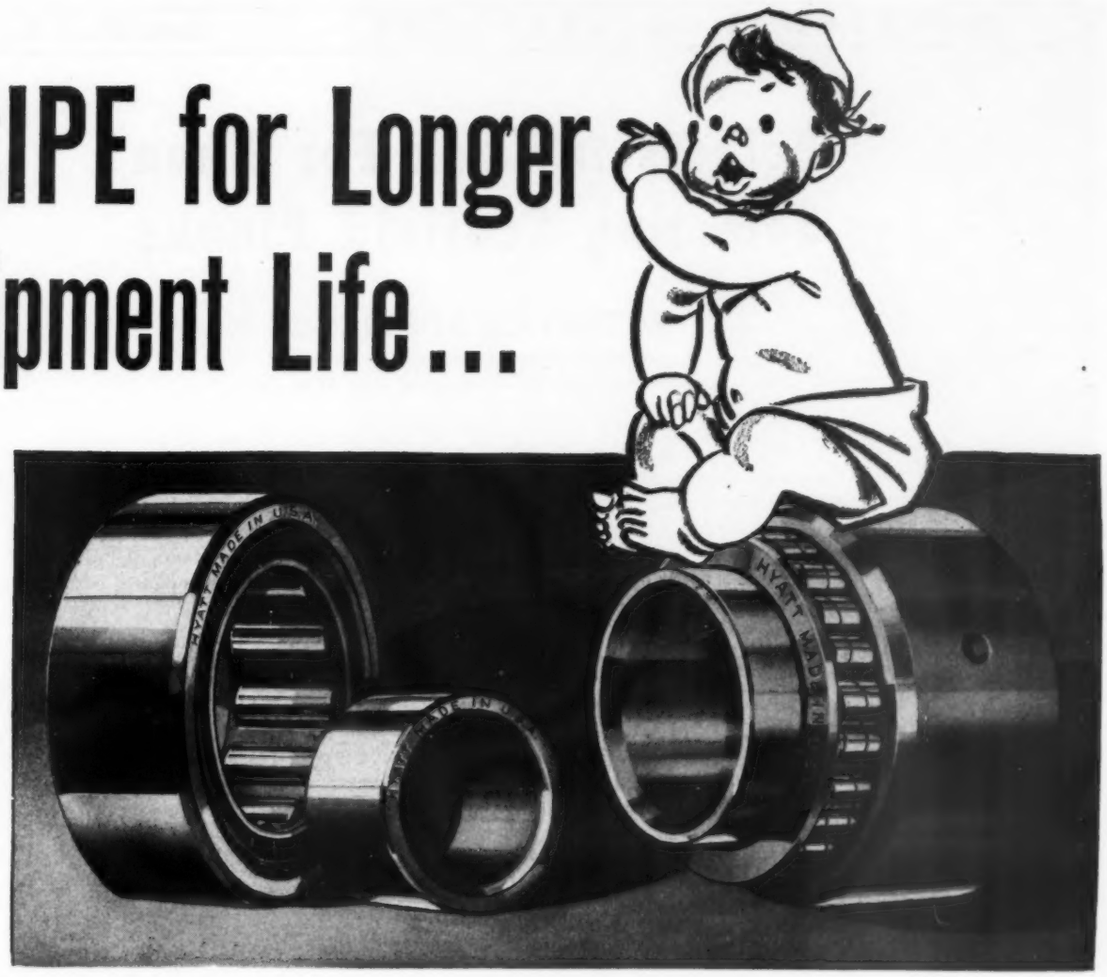


FIGURE 3

RECIPE for Longer Equipment Life...



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HYATT

ROLLER BEARINGS

QUIET

Defects to Look For When Selecting Scaffold Planks

W. ELWOOD ROSSNAGEL
Safety Engineer, Insurance Department
Consolidated Edison Company of New York, Inc.

SCAFFOLD PLANKS should have a "strength ratio" of at least 80 percent; that is, the actual plank with all its inherent defects should have 80 percent of the strength of a theoretically perfect plank. This means that tabular figures of the strength properties of small specimens of various species of clear, dry wood should be reduced 20 percent before dividing by the factor of safety to obtain the safe working load. Specifications should limit the size and number of defects so as to attain that strength ratio.

Here are defects to be considered in drawing specifications and inspecting planks:

1. Light weight. In general, the strength of wood varies as the density or weight. Therefore, any planks that are exceptionally light-weight should not be accepted.

2. Decay. Wood containing decay in any form is unacceptable, as such wood is low in strength. Red heart, a form of decay, is detected by a streak or patch of reddish brown wood near the heart or pith of the tree. It should not, however, be confused with heartwood which in many species of wood is of darker color than the sapwood. Boxed heart material (that containing the pith) should not be accepted.

3. Warping. Planks should be properly seasoned in order to be acceptable. Wood having a high moisture content is heavy, and should not be confused with dense, strong wood. Planks should be free from warping, either by bowing, crooking, cupping, or twisting. If they have been properly seasoned, there is less chance of warping due to climatic changes after inspection.

4. Wane. In sawing up a log into standard planks or other sizes, frequently a piece is found having bark, or lack of wood, showing at one or two edges. This is known as wane, and should be limited to 1⅛ inches in width, measured parallel to the annual rings.

5. Shakes. In the growing tree separations frequently develop between the annual rings, as observed on the end of the plank. Such separations are known as wind shakes. If planks were always to be used lying flat, shakes would not have any significant effect on their strength. However, in built-up scaffolds, planks are often used on edge for ledgers, putlogs, outriggers, either whole or part lengths being used. If a plank on edge has a span less than twelve times the depth (9 feet for a 9-in. plank), there is greater probability of failure by horizontal shear than by flexure. In other words, if the plank is overloaded, it will probably split along the neutral axis, or middle of the depth, into two separate beams which may slip on each other along this plane of cleavage, after which each part will then fail independently by flexure.

Anything that reduces the resistance to horizontal shear, therefore, reduces the strength of a plank on edge. Thus, shakes appearing near the ends of a plank within the middle half of the width of the wide face, are considered a defect. Should the shake, as observed on the end of the plank, exceed ⅝ inch, measured between lines just enclosing the shake and drawn parallel to the wide faces, the plank should be rejected. Shakes that extend to the surfaces of the plank should also be prohibited.

6. Checks. Checks are similar in effect to shakes. These are the longitudinal splits or separations between the fibers of the wood, which extend radially or at right angles to the annual rings, as observed on the ends of the plank. The width of a check has little influence upon the strength of a plank, an almost invisible check being as detrimental as a wide one. Like shakes, checks occurring within the middle half of the wide face of the plank, within three times the width (27 inches) from either end, should be limited to ⅝ inch deep. If shakes and checks are both present, their sum at any point should not exceed ⅝ inch. Checks or splits extending through the plank from face to face should not extend more than 3 inches from either end of the plank.

7. Pitch Pockets. Sometimes small shakes fill up with pitch and as such are known as pitch pockets. These should be limited to about 2 inches in length, ⅛ inch in width, and ½ inch in depth, and they should not occur closer than about four feet apart.

8. Knots. Perhaps the most serious defect is the knot. Knots on the narrow faces of a plank are measured by their width between lines drawn parallel to the edges of the plank. Those on the wide faces are measured by their mean or average diameter; that is, half the sum of the major and minor diameters. Spike knots (those long, slightly curved, triangular knots) are measured by taking half the sum of the length and the greatest width. Knots showing on both a wide and a narrow face are measured on the wide face only. Knot holes, and holes from any cause, are measured the same as knots. Strange as it may appear, a loose incased knot (a dead knot surrounded by bark), or a knot hole, has a slightly less detrimental effect upon the strength of a plank than a good sound knot, as in the former case the fibers of the wood are distorted less at the knot. Nevertheless, knot holes should not exceed 1 inch diameter, due to the hazard of tools or material falling through them.

On the narrow faces of the plank, knots should be limited to ⅜ inch if they occur within the middle third of the length of the plank, but may gradually increase in size from that section to ¾ inch at either end of the plank. Near the edges of the wide faces of the plank knots should be limited to 1 inch in the middle third of the length, but may gradually increase in size from that section to 2 inches at either end of the plank. Along the centerline of the wide faces, knots should not exceed 1¾ inches anywhere along the length of the

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Defects to Look For When Selecting Scaffold Planks

plank. Knots appearing between the edges and the centerline of the wide faces are allowed to be intermediate in size between those that are allowed near the edge and those at the centerline.

In order that the plank will not be weakened too much, the number of knots should be limited. The sum of the sizes of all knots occurring on the poorer of the wide faces within the middle half of the length of the plank should not exceed 8 inches or 4½ times the size of the largest knot permitted in that section. The sum of the sizes of the knots within the middle half of the length on either narrow face should not exceed 1¾ inches.

Cluster knots and knots in groups should be prohibited. Knots are considered grouped if the space between any two knots is less than the sum of the sizes of those two knots.

9. Cross Grain. Cross grain is a general term describing the fibers that do not run parallel to the edges of the plank. It may exist in several types, principally diagonal grain and spiral grain. Diagonal grain is measured on the radial or edge-grain faces of the plank, and is usually caused by sawing the plank from a crooked log. Spiral grain is caused by the fibers growing spirally around the pith of the tree, and is measured on the tangential or flat-grain surface furthest from the pith. Cross grain should be limited to an angle of 1:17 within the middle half of the length of the plank, but may be increased to 1:12 near the ends. The angle is determined by measuring the distance in which the grain deviates 1 inch from a straight longitudinal line.

On a rough plank perhaps the best method of checking the direction of the grain is by picking up splinters upon the point of a sharp knife and noting the direction in which they pull. Or areas about ½ x 1 inch on the faces of the plank may be cut smooth with a knife at various locations, and the point of a fountain pen touched to the smooth wood. The direction in which the ink runs in the cells of the wood will indicate the true grain. Checks always indicate the angle of spiral grain if it exists. Local deviation caused by knots, pitch pockets, etc. should not exceed the angles specified if within ½ inch of the plank edges.

Cross grain causes a reduction in the strength of a plank and therefore should be kept at a minimum. But spiral grain should be avoided for an additional reason. A plank containing spiral grain will twist as the moisture content of the wood changes with varying climatic conditions, and a warped plank is unpleasant, if not unsafe, to walk upon, as it rocks under the weight of each foot as a man steps on it.

10. Compression Wood. An exception to the rule that the strength of a piece of wood usually varies with the weight, is compression wood. While rather heavy, it has low resistance to shock. Compression wood, indicated by wide, eccentric annual rings showing a high percentage of denser summer wood, should not be permitted in scaffold planks.

11. Brashness. Brashness is another serious defect. It corresponds to brittleness in metals, and brash planks usually fail without warning sounds, and with a splinterless but rather crystalline fracture. They are particularly weak under shock or impact loads. Brashness may be present in new lumber, or it may be the result of the wood having been stored for a long period of time in a very warm, dry atmosphere. Exceptionally wide or exceptionally narrow annual rings will usually make the inspector suspicious of the wood. Brash wood, of course, is unsafe for scaffold purposes.

Tests for brashness can be made when making the splinter test for cross grain. The point of a sharp knife blade held flat should be jabbed into the wood at an angle of about 10 to 15 degrees to the surface. The knife blade is then slowly rotated above the adjacent wood. It is not necessary to cause the splinter to break off and thus create a hazard to the hands of the men who will handle the planks. If the wood is tough the splinter will tear away from the rest of the wood for some little distance, but if the wood is brash a piece will break off, and without splinters. As there are all degrees of brashness, there can be no definite line of demarcation between tough and brash wood, and it will be the duty of the inspector to decide whether or not to accept a questionable plank.

12. Compression Failures. Under stress wood behaves quite differently from metals. The tensile strength of wood is several times as great as the compressive strength. When a piece of wood is subjected to excessive bending stress, the fibers on the compression side will fail by buckling long before those on the tension side rupture, and they produce what is known as a compression failure.

In finished lumber, a compression failure may be observed as an irregular whitish line running across the face of the piece, usually at about 70 degrees to the edge. It can be detected only by an expert who will view the surfaces of the piece from different angles and with the light source in various positions.

✦ ✦

Only dependable lumber should be used for scaffold planks. Eastern spruce is usually employed, as its strength is high in proportion to its weight. Scaffold planks may be purchased by grade or, where they are ordered in large quantities, may be required to meet exacting specifications.

Scaffold planks are cut to unusual dimensions, namely, 13 feet long and 2 x 9 inches in cross-section. When dry, the cross-section dimensions are actually about 1⅞ x 8¾ inches.

All planks meeting the requirements of the specifications and passing the load test should be immediately branded on the ends, or otherwise permanently marked as suitable for scaffolds, and the use of any other planks for scaffolds should be forbidden. Inspected planks should be handled carefully, and not dropped in bulk from the delivery truck. They should be handled with care during the construction or demolition of scaffolding and at all other times, as compression failures may be developed when an approved plank is dropped or when a load of unknown magnitude is applied to it.

It is not expected that planks to meet these requirements can be picked from the common grades of lumber, but must be selected from a higher grade of material.

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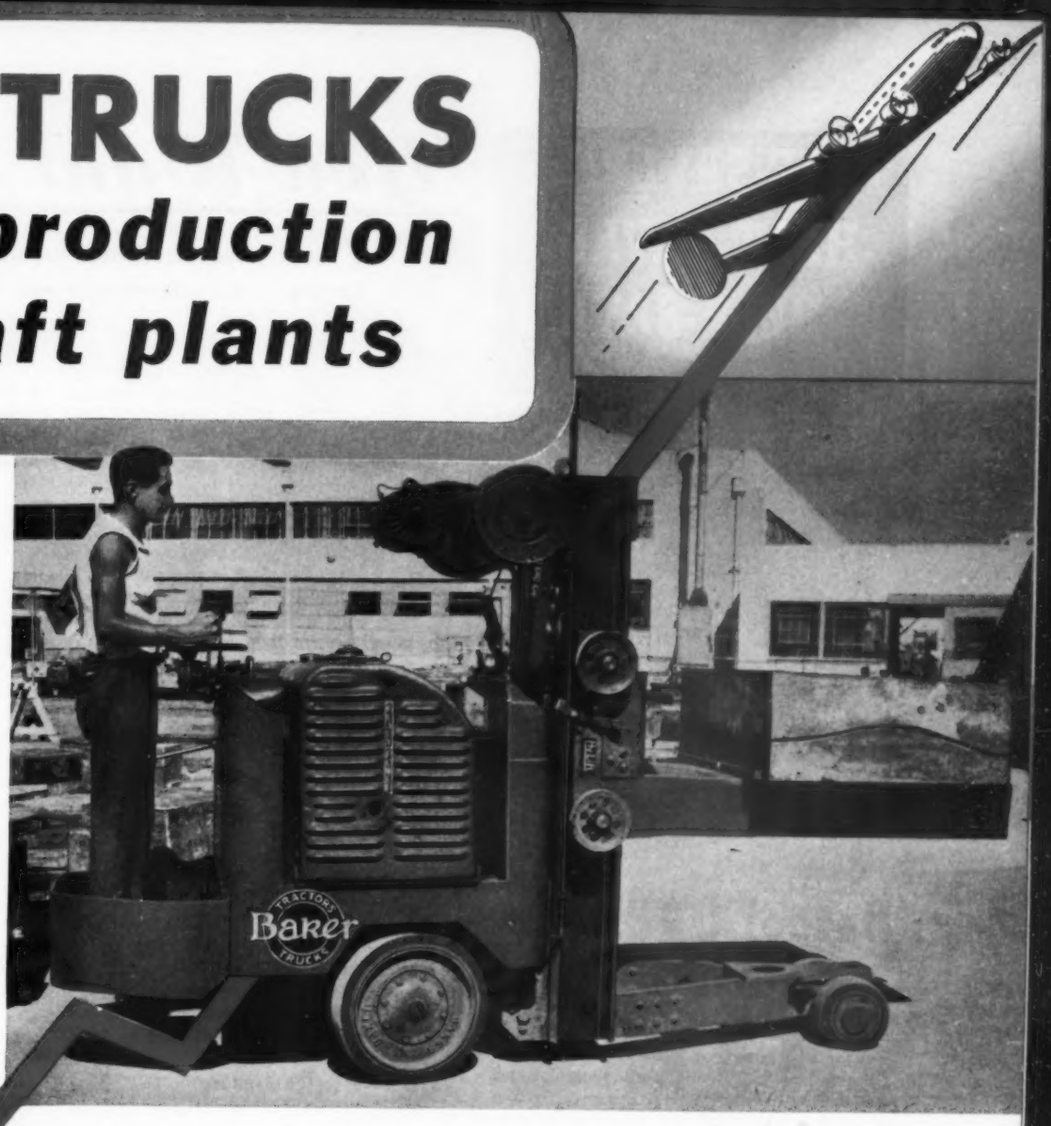
step up production in aircraft plants



BAKER TRUCK AT NORTH AMERICAN (Right) Changing and moving dies is a much faster, simpler and safer operation with this 6000 lb. capacity Hy-Lift Truck with die-pulling winch, in service at the North American Aviation plant at Inglewood, California.

BAKER TRUCK AT WRIGHT AERONAUTICAL (Below) Six radial engine crankcases are handled easily with this Baker Low-Lift Elevating Truck — one of 8 in service at the Wright Aeronautical Corporation, Paterson, N. J.

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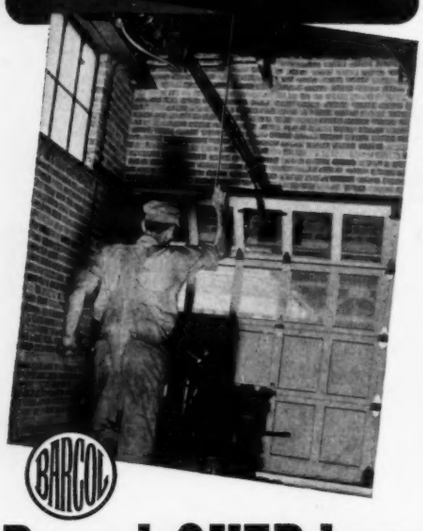

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You Want to Know

more about the items mentioned on this page. Letters to the addresses given will bring information

• STAINLESS-STEEL protractor plate of a drafting machine is graduated in 2-deg. intervals and can be set for ½-deg. readings by use of the graduated vernier. Although the protractor can be locked at any degree, it has a latching spring to lock scales at 0, 30, 45, 60, and 90 degrees on both sides of the 0. Maximum sheet size used is 24x36 inches. The Drafto Co., 153 Walnut St., Cochranton, Pa.

• METHODS USED by various companies to solve defense work personnel problems are outlined in "Company Problems of Multiple-Shift Operation," 50c; "Industrial Training Programs for Increased Production," 75c; "Selection and Development of Foremen and Workers," 75c. American Management Association, 330 West 42d St., New York.

• ENGINEERS, maintenance men, production managers, and purchasing agents who write in for the Ohm's Law calculator slide will find it mighty handy in figuring volts, amperes, wattages, and resistances because one setting gives the answer to any given Ohm's Law problem. It is scaled to 1,000 ohms on one side and to 10,000 megohms on the other. Ohmite Mfg. Co., 4835 Flournoy St., Chicago.

• CLOCKING split seconds is everyday business to a portable chronoscope said to measure one to 200 milli-seconds with less than one percent error. Useful in indicating projectile velocities, it also checks time consumed by operations where an electrical impulse can be obtained at the beginning and end of the event. E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

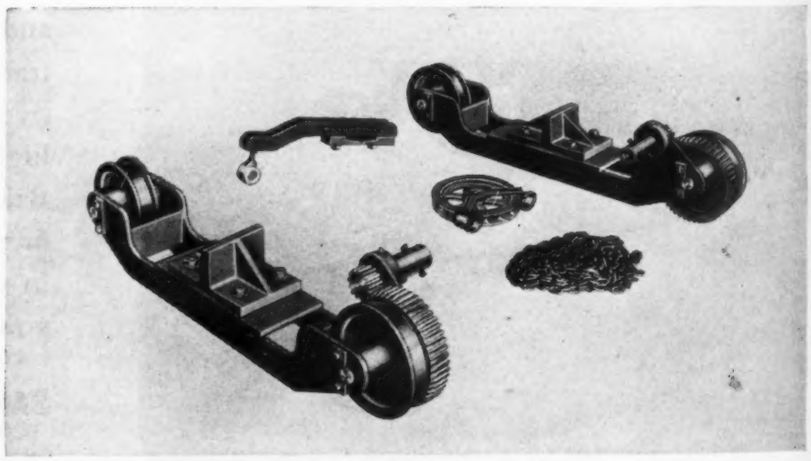
• WATERPROOFING COMPOUND, colorless liquid, brushed or sprayed on masonry, is said to penetrate ¼ to ¾ inch to form a gum that renders the masonry leakproof and free from seepage, deterioration, alkali, or efflorescence. Hydrozo Products Co., 2725 Kendall Ave., Madison, Wis.

• SOME IDEA of what policies are being followed by various companies as regards military training and service may be gained from a preliminary report based on questionnaires filled out by 201 companies operating in Los Angeles County. Bulletin 4-A. Industrial Relations Section, California Institute of Technology, Pasadena, Calif.

• INDEX to A.S.T.M. Standards, including tentative standards, is of use to those wishing to ascertain whether the Society has issued standard specifications, test methods, or definitions covering a particular engineering material or subject. Indicates volumes where the standards appear. American Society for Testing Materials. 260 South Broad St., Philadelphia.

• GOVERNMENT SPECIFICATIONS on alloy steels been puzzling you? Chart listing 23 Army and 17 Navy specifications for alloy steels, including chemical analysis and nearest corresponding SAE number for each, should be a big help. Peter A. Frasse & Co., Inc., 17 Grand St. at Sixth Ave., New York.

• ELECTROLYTIC COPPER is treated by a special process said to return to it certain elements which accelerate the formation of a tough film; prolong the life



ONLY A WRENCH, an I-beam section, and about an hour's time are required to transform packaged crane assemblies into traveling-bridge or jib cranes. There are no holes to drill, nor machine work to be done. Shaw-Box Crane & Hoist Division, Manning, Maxwell & Moore, Inc., Muskegon, Mich.

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LATTICE-BRAID

of the copper; and increase its tensile strength, endurance limit, and corrosion resistance. Sheets, rolls, and strips for roofing and building use. Revere Copper & Brass Inc., 230 Park Ave., New York.

• NON-FERROUS high-nickel alloy in rod and wire forms is free-machining and non-magnetic. It features high strength and corrosion resistance and can be fabricated in automatic screw machinery and heat treated after fabrication. The International Nickel Co., Inc., 67 Wall St., New York.

• NEW WIRE SIZES and capacities based on the 1940 National Electrical Code can be rapidly found with the aid of a handy calculator which also contains data on motor-circuit wiring. BullDog Electric Products Co., 7610 Jos. Campau Ave., Detroit.

• HANDS OF WORKERS dipped into a water-like solution take on an invisible film that greatly reduces hand perspiration and thus protects metal products—bearings, airplane parts—against rust and the skin against irritations encountered in handling synthetics, explosives, dies, plating baths, and the like. The Milburn Co., Detroit.

• DIAL-TYPE CALCULATOR, 8¾ in. diameter, simplifies calculations in determining proper size and type of drain to use under specific conditions affecting drainage in all types of buildings. $1. (Limited free distribution to those concerned with specification of building drainage products.) J. A. Zurn Mfg. Co., Erie, Pa.

• PAMPHLET briefly analyzes the principal economic problems relating to defense which puzzle the public and points out the necessity of formulating national policies looking beyond industrial management and production. 25c. The Brookings Institution, Washington, D. C.

• MARK-SENSING reproducing punch sensitive to pencil marks, saves time by automatically punching data in tabulating-machine cards in conformity with pencil markings on the original record. Punches ten columns on one run. Double-marked or unmarked columns stop the machine and thus make known any errors. International Business Machines Corp., 270 Broadway, New York.

• ELECTRICAL PORCELAIN combines high-dimensional fidelity of dry-process porcelain with the dielectric strength and mechanical characteristics of wet-process material and is thus particularly adaptable for intricately shaped pieces. (Dimensions can be held accurate within 1½ percent, they say.) Westinghouse Electric & Mfg. Co., East Pittsburgh.

• MARCH MARKS the first issue date of a new four-page monthly publication, "Link-Belt Speeder News," devoted to applications of shovels, draglines, and cranes designed for low-cost handling of materials. Link-Belt Speeder Corp., 301 West Pershing Road, Chicago.

"35% MORE LIGHT WITH SAVE-LITE!

REPORTS LINK AVIATION DEVICES, INC.

(Sprayed by Binghamton Service & Painting Co.)

BEFORE and AFTER: Shadows and Glare banished by One Coat of SAVE-LITE White Paint!

"MAKING Link Trainers is a precision job, and good light is vital!" says E. A. Link, Pres. Link Aviation Devices, Inc. "That's why we selected Sherwin-Williams Save-Lite white paint for reconditioning an old plant we recently took over. As the photos show, Save-Lite literally transformed the old plant into a bright, cheery workshop. One coat of this high-light-reflecting paint raised lighting levels to 65 foot-candles—an increase of 35%! It covered brick, wood and cement perfectly."

Time-tried, light-reflecting white Save-Lite increases working light amazingly. It has reduced errors, improved housekeeping, cut workers' fatigue and eye-strain in many plants in all lines of industry. And it covers so well, spreads so far, stays white so long, that it really is more economical than many cheap "mill whites." Mail coupon today for complete data. Sherwin-Williams Co., Cleveland, Ohio and all principal cities.

SHERWIN-WILLIAMS

SAVE-LITE

COVER THE EARTH

THE SHERWIN-WILLIAMS COMPANY
103 F. Prospect Avenue, N. W., Cleveland, Ohio

Gentlemen:
Please send information on better illumination with white paint and the facts on Save-Lite White.

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SLEEVE BEARING DATA

● Sleeve Bearings of today are precision-made products. They more than prevent wear and reduce friction—but definitely aid the performance of a motive unit. Accordingly, they should be designed and produced to fit the individual application. Only by so doing can you expect to gain the maximum life and service.

It is an easy matter to build this type of bearing performance into your product. Simply determine *all* the factors that in any way effect bearing operation.

Johnson Bronze can help you in this. We have prepared a vast array of Data Sheets. These cover practically every phase of sleeve-type bearings —such as Lubrication, Design, Alloys, Physical Characteristics, etc. The complete set—in a handy file folder—is yours for the asking. Why not write for this information today?

JOHNSON BRONZE
512 SOUTH MILL STREET
NEW CASTLE, PA.

What's New in Equipment

Ignitron Tubes

Ignitron tubes for resistance welder control are able to carry very high peak currents for short periods, it is said. They

feature inner and outer jackets of stainless steel and are corrosion resistant. Available in ratings suitable for controlling nearly all sizes of resistance welding machines. General Electric Co., Schenectady, N. Y.

Electric Hoist

CM Comet one-ton electric hoist is suitable for all types of hoisting service. It is available with hook suspension or with a trolley attached for overhead conveyance. Heavy-duty high-torque motors are supplied for either 110-volt lighting circuits or 220 or 440-volt power lines. An emergency brake plus automatic upper and lower limits guard against hoist abuse and insure safety. One-hand control leaves one hand free to direct load into position. Chisholm-Moore Hoist Corp., Tonawanda, N. Y.

Gas-Fired Unit Heaters

For any kind of gas—natural, mixed, manufactured, and bottled. Self-contained, the heaters produce and deliver heat on the spot and are for use in cellarless buildings, in selected areas where heating is desired steadily or intermittently. Available in eight sizes with capacity ranging from 55,000-200,000 B.t.u. per hour. Carrier Corp., Syracuse, N. Y.

Boiler Return Trap

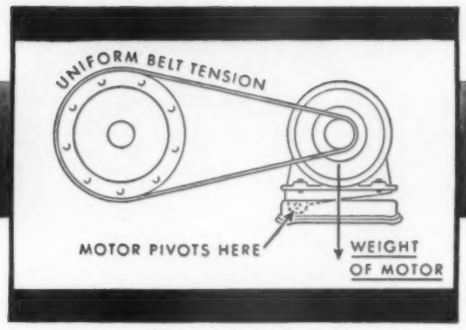
The controlling valve gear of a redesigned Electrap is gathered into one assembly and mounted on the receiver (Type S) or separately (Type SR) so that the trap can be brought out to a convenient location when the trap receiver is located in some inaccessible spot. Thus the receiver is without stuffing boxes, floats, or moving parts and so simplifies service and inspection. Serves wherever the conventional trap can be used —returning condensate to boilers, lifting or pumping water or other liquids, or draining systems under vacuum. Available in sizes suitable for boilers from 20-200 hp., withstands pressures up to 150 lb., discharges up to 21,000 lb. of water per hour, it is said. Johnson Corp., Three Rivers, Mich.

Flue-Still Hose

Designed to withstand deterioration caused by action of oil and high external heat when used in cleaning tubes of stills in petroleum, chemical, and other refineries, a flue-cleaning hose features rough-bore construction with synthetic frictioned fabric, synthetic oil-resisting tube, asbestos cover, and internal and external wire winding. The tube keeps out the oil and withstands the heat, the rough bore construction protects against hose collapse, wire winding prevents kinking or twisting and guards against tearing of cover by abrasive scale. Suitable for use with air up to 125 lb. pressure or with steam up to 80 lb. pressure. The B. F. Goodrich Co., Akron.

Drilling and Boring Appliance

Designed for drilling and boring in positions and spaces in which it would be impossible to use an electric drill by itself. The drill head carrying the chuck which holds the drill is small enough to go into restricted spaces so that it is possible to drill at any angle in nearly 360 deg. and in any plane. This permits drilling through



We call it a VIM EFFICIENCY DRIVE!

Many a power transmission headache is being cured today by VIM Efficiency Drives—so named because this type of drive is conceded by engineers to be the most efficient for short-center installations.

Simple to install and maintain . . . and highly economical and efficient in operation, a VIM Efficiency Drive consists merely of a Certified VIM Tred Leather Belt used in conjunction with a pivoted motor base (see illustrations).

Plant men throughout the country are familiar with VIM TRED Leather Belting—its distinctive, non-skid treaded surface—its high coefficient of friction, greater flexibility, higher tensile strength—and the fact that it is certified to cost less per unit produced.

Combine this great belt with a pivoted motor base, which automatically maintains a uniform driving tension at all speeds and loads, and you have a drive which can be depended upon for greater production and requires less maintenance than ever before.

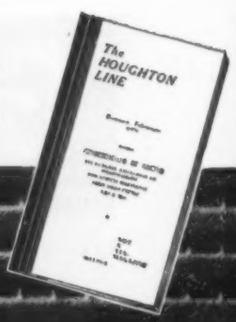
Houghton transmission engineers, available in all industrial areas, are always ready to aid in the solution of your belting problems. Send for the Houghton Man, or write for "How to Belt Your Drives for More Profit."

Investigate also OKAY Tred Leather Belting, a specially tanned treaded leather belt, proven superior to first grade oak, yet costing no more.

★

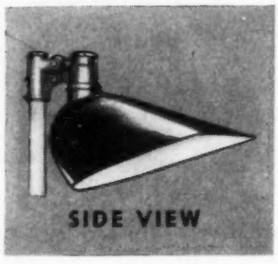
E. F. HOUGHTON & CO.

Chicago - PHILADELPHIA - Detroit



VIM TRED & OKAY TRED LEATHER BELTING

—provides brilliant illumination for protective floodlighting of industrial properties; for parking spaces, athletic fields, gasoline service stations, and other large areas where a uniform, high intensity of illumination is desired.



SEAMLESS CONSTRUCTION

This floodlight is formed from one piece of metal, without seams of any kind. Not only have mechanical construction and design been improved, but the already high efficiency of the No. 90 has also been increased. With permanent porcelain enamel finish, it is weather-proof, rugged, ready to deliver efficient service for years to come.

The new No. 90 Floodlight is equipped with cast aluminum ventilated hood for pole or bracket mounting, and accommodates lamps of from 750 to 1500 watts. Available also for mercury or Bipost lamp operation. Catalog sheets on request.

GOODRICH INDUSTRIAL LIGHTING

The Goodrich line covers the complete range of industrial lighting equipment, including all RLM-approved fixtures, fluorescent fixtures, etc., as well as many exclusive designs. Literature is available on all Goodrich fixtures.

SOLD ONLY THROUGH ELECTRICAL WHOLESALERS

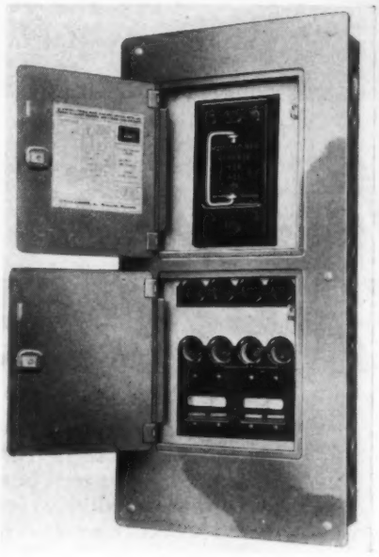
GOODRICH
ELECTRIC COMPANY
OFFICES IN ALL PRINCIPAL CITIES

GENERAL OFFICES AND FACTORY: 4604 BELLE PLAINE AVENUE, CHICAGO, ILL.

a joist at any angle to the face and in a restricted space between joists on centers as low as 8¾ in. or on joists 10 ft. above the floor while the operator stands on the floor. In boring through wood, the pit pulls its way through without application of pressure. In drilling through metal, force is applied through the longitudinal axis. The appliance is telescopic and is attached to the electric drill by a clamp fitting around the neck of the drill (available in several sizes). The KU-2 is a heavy-duty universal drill extension for use in boring up to 2-in. holes through wood or metal plates. The next size bores holes up to 1¼ inches. Attachments are available for use on ¼-in. drills. Kett Appliance Co., Union Central Building, Cincinnati.

Switch

Line of 100-amp. pull-out-type service control switches features dead-front construction, Bakelite switch base, 3-wire grounded solid neutral, solderless lugs on



60 and 100-amp. terminals, slots in cover and case for sealing. The switch is available with or without branch circuits, the 100-amp. pull-out type is rated at 230 volts a.c. Also available with two 60-amp. pull-outs and 4, 6, or 8-plug fuse circuits rated at 115/250 volts. Surface or flush mounting. Cutler-Hammer, Inc., 315 North 12th St., Milwaukee.

Transmission Photometer

For application to transmission measurements where small areas are important, the photometer has special value in such work as quantitative spectographic analysis because it eliminates the "human element" in comparing the densities of spectral lines. The operator can see a magnified portion of exact field being measured. Apertures provided in the screen may be changed by changing position of the diaphragm. The slit diaphragm can be rotated to align image of spectral line with split aperture. Provision is made in diaphragm for any shaped aperture to accommodate special conditions of measurement. After final adjustment the optical parts

"A RECORD FOR CONSTANT OPERATION"

Trouble-free turbine means trouble-free operation for prominent fuel company.

A case history showing the trouble-free service you can expect wherever you see the Coppus **BLUE RIBBON**

"This turbine pump has performed 24 hours a day for more than three years and has never been shut down... is still operating 24 hours a day, and we have never had any maintenance cost of any kind on either turbine or pump. This is a record for continuous operation for any piece of machinery we have ever installed."

To insure consistently dependable operation of turbine-powered equipment, write "Coppus" on your specification. The "blue ribbon" painted on the flange indicates:

1. **PRECISION WORKMANSHIP**—controlled by Johansson size blocks.
2. **ENCASED GOVERNOR**—slow speed, leverless.
3. **SEPARATE SAFETY TRIP**—pilot-operated, leverless.
4. **PARTIAL LOAD ECONOMY**—by individual nozzle control.
5. **DYNAMOMETER TESTED**—before shipment.

During 1940, 87% of orders for Coppus Steam Turbines were repeat orders. Bulletin 135-9 describes vertical and horizontal types; also with built-in speed reducer. Steam, air or gas-operated. Write for this bulletin today.

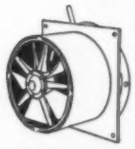
H. P. not E. P.* for small H. P. jobs.

*Elephant Power—a large-size turbine for a job a small-size Coppus could handle. Save investment cost with a Coppus Turbine sized close to your needs.

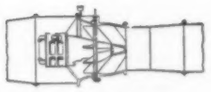
COPPUS ENGINEERING CORP., 207 Park Ave., Worcester, Mass. Sales offices in THOMAS' REGISTER. See SWEET'S for other "Blue Ribbon" products—air filters, gas burners, blowers, ventilators, fans.

COPPUS BLUE RIBBON PRODUCTS

Designed for your Industry
Engineered for You

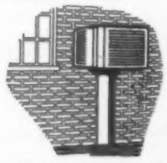


COPPUS-DENNIS FANMIX GAS BURNER. New method of mixing gas and air insures perfect gas-air ratio—instant, complete combustion. Bulletin 410-2.



COPPUS VANO BLOWERS. 1001 uses. High efficiency on special installations where ordinary fans fail. Bulletin 115-6.

COPPUS CABLE MANHOLE AND TANK VENTILATORS. For any confined working space. Special adaptions for boilers, tank cars, shipholds. Bulletin 163-1



COPPUS AIR FILTERS. For engines and air compressors. Perfect, uninterrupted filtration. Bulletin F-310-4.

COPPUS

A SOAP TO SAVE

SOOTHING... NOT ABRASIVE SOFTENING.. NOT CAUSTIC

WORKING EFFICIENCY

Economical because of its high number of washes per pound . . . and so efficient

Workmen with hands toughened, stiffened and made dermatitis-susceptible by harsh washing cost you money. You pay for it now . . . but *CAN* repair the situation.

LANOKLEEN

supplies the means—a new industrial hand cleaner that is JUST AS POWERFUL in cleansing qualities as any detergent—soap you are using BUT GENTLE IN ACTION. No abrasive grit. No harsh caustics, LAN-O-KLEEN uses non-abrasive corn-meal to rub out the dirt and a SPECIAL IMPREGNATION with lanolin. This important animal oil (1) buffers the mild soap alkali and (2) helps restore the natural oiliness to the skin. There's nothing else like it!

Yet LAN-O-KLEEN costs no more per washing than other soaps.

Clip the Coupon and let your men's enthusiasm prove what we say.

WEST DISINFECTING COMPANY

A GUARANTEED PRODUCT

42-16 WEST ST., LONG ISLAND CITY, N. Y.

Attention Dept. J

I am interested in your FREE TRIAL offer of a Dispenser and sufficient LAN-O-KLEEN to test out for 2 to 3 weeks in one department. Please get in touch.

Name of Individual.....

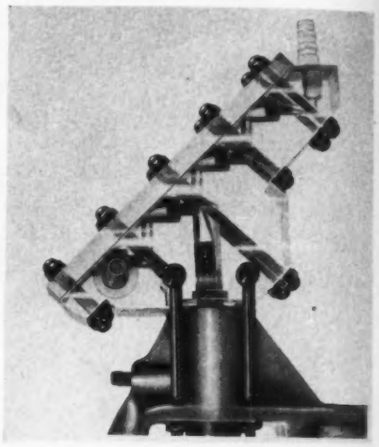
Name of Company.....

Street & City.....

remain fixed and require no further movement for focusing. Other conveniences include horizontal plane mounting, vernier adjustment of plane in direction of wavelength axis, focusing by up and down movement of the stage, etc. General Electric Co., Schenectady, N. Y.

Transparent Plastic Pump

Machined from a block of chemical-resistant crystal-clear plastic material, Plexiglas, this pump is used in handling dilute acids, hypochlorites, and other chemicals. It permits visibility at all times of the flow



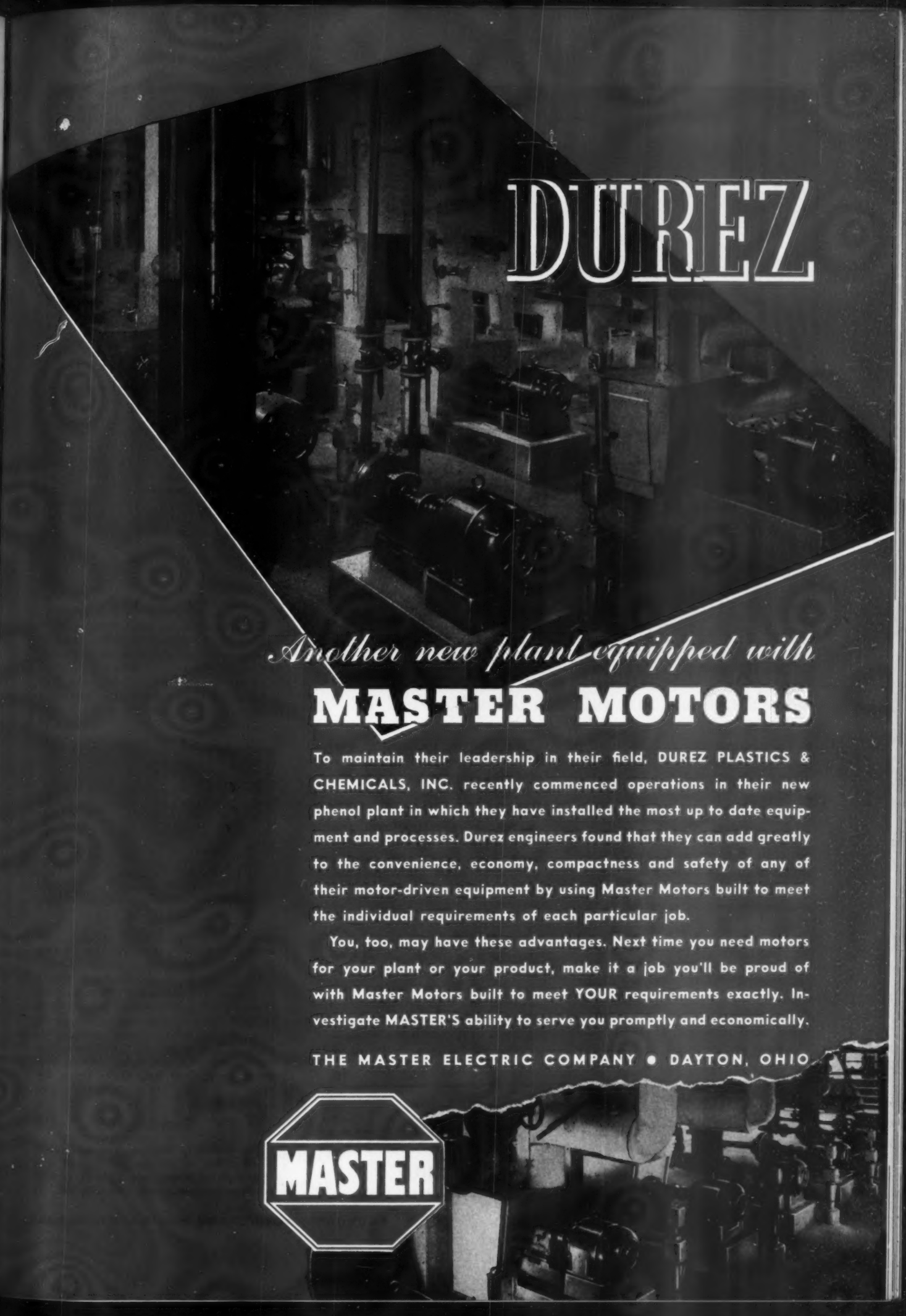
of liquid being pumped and movement of valve checks and pump piston. Inlet and outlet hose nipples are of plastic construction; the piston is Hastelloy C. Flat-plate cover permits cleaning of valve assembly without disturbing pipe connections to the pump. Available in capacities of ½ to 20 g.p.h. Milton Roy, 1311 East Mermaid Ave., Philadelphia.

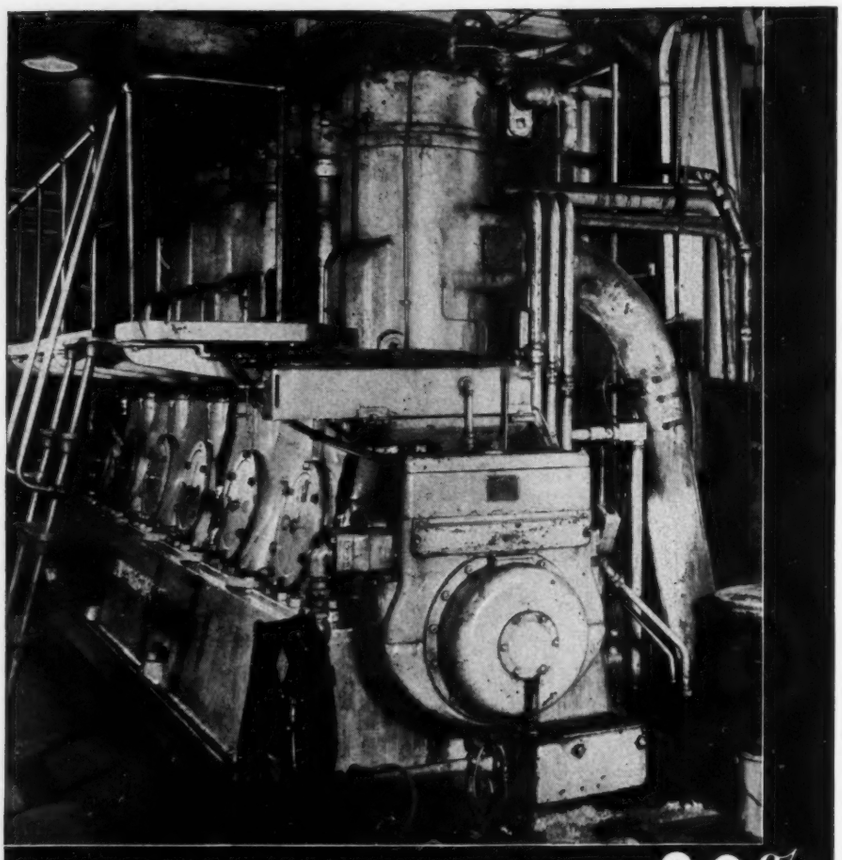
Float Switch

Type J is designed and packaged for the man in the field and comes complete with a bracket for wall mounting plus screws and expansion shields. May be used on a pipe for floor mounting using a U-bolt. Float, counterweight, and cable are included in the package. The switch uses a snap-action mercury contactor and is built of non-corrosive materials. Single pole, 110, 220, 440 volts, a.c. or d.c. Type JCX is explosion proof. Automatic Control Co., 1005 University Ave., St. Paul.

Container

Main feature is the construction of the skid and stacking runner. Built-up skids extend slightly beyond the box area to provide increased stacking surface. Each skid has a stacking runner attached. If the box is large, a one-piece cleat is attached to the bottom at the center of the box. Said to facilitate loading and unloading of one or more boxes by the lifting fork of a power lift truck. As each box is piled upon the stack the beveled stacking runner slides into the top of the box below to prevent dislodging of the boxes. The boxes are of woven wood and wire


DUREZ
Another new plant equipped with
MASTER MOTORS
To maintain their leadership in their field, DUREZ PLASTICS & CHEMICALS, INC. recently commenced operations in their new phenol plant in which they have installed the most up to date equipment and processes. Durez engineers found that they can add greatly to the convenience, economy, compactness and safety of any of their motor-driven equipment by using Master Motors built to meet the individual requirements of each particular job.
You, too, may have these advantages. Next time you need motors for your plant or your product, make it a job you'll be proud of with Master Motors built to meet YOUR requirements exactly. Investigate MASTER'S ability to serve you promptly and economically.
THE MASTER ELECTRIC COMPANY • DAYTON, OHIO
MASTER



Time Out for Clean-Up Cut 80% Fuel Saving—Almost a Tank Car Per Year

● This improvement in operating efficiency results from the combined use of Lubri-D-Zel Lubricating Oil and Diesel Fuel Concentrate.

At Burdett Oxygen Company, Cleveland, a 360 h.p. Fairbanks-Morse two-cycle diesel supplies power for compressors run 24 hours a day the year 'round. The only shut-downs are for engine clean-up or repairs.

Superintendent Rankin says, "We formerly had to clean all six exhaust ports every 7 to 10 days, an operation requiring 2½ hours. Now, with Lubri-Zol, we can run steadily for 30 to 45 days and then only one or two exhaust ports need attention. Inspection and clean-up are reduced to 1½ hours.

"We like the increase in over-all efficiency the engine has shown on Lubri-Zol. It amounts to a saving for us of almost a tank car of fuel oil in a year."

Research investigations, supplemented by operating experiences like the above, have shown that the greatest improvement is made when Lubri-D-Zel Lubricating Oil *and* Diesel Fuel Concentrate are used. The combination produces better results than when either is used singly.

In the field of diesel lubrication, Lubri-Zol stands foremost in development of products, to improve engine performance. Our engineering staff, specializing in diesel lubrication, is prepared to demonstrate what Lubri-Zol can do for you. Write us today.

LUBRI ZOL

THE LUBRI-ZOL CORPORATION
CLEVELAND, OHIO

webbing mounted upon a framework and are reinforced at the corners with steel stampings. Other constructions are available. They are uniform in size, may be stacked ceiling high, and may be used for intra-plant traffic and for shipping. The G. B. Lewis Co., Watertown, Wis.

Unit Heater

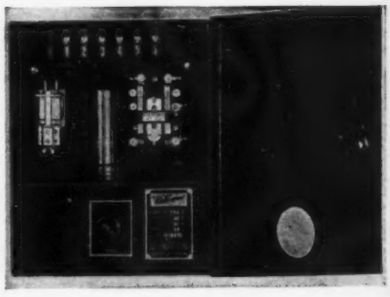
Downblast Speed Heater projects heat directly downward and is thus suited for installation in buildings with high ceilings as much as 40 ft. above the floor level. Twelve sizes with capacities ranging from 40,000-400,000 B.t.u. per hr. at 2 lb. steam, 60 deg. entering air. For a comparatively low installation, deflection cones are incorporated to diffuse the heated airstream. B. F. Sturtevant Co., Hyde Park, Boston.

Eyeshield

Type BX is a cover-all shield for use on gas-welding, cutting, and blowtorch operations. It does not interfere with wearing of prescription glasses. Features: Opaque fiber side pieces, standard 2- by 4¼-in. lens held in the retaining frame by a spring, adjustable shield to provide proper lens angle with reference to the face, light weight. It is also said to be non-fogging. Jackson Products, Detroit.

General-Purpose Timer

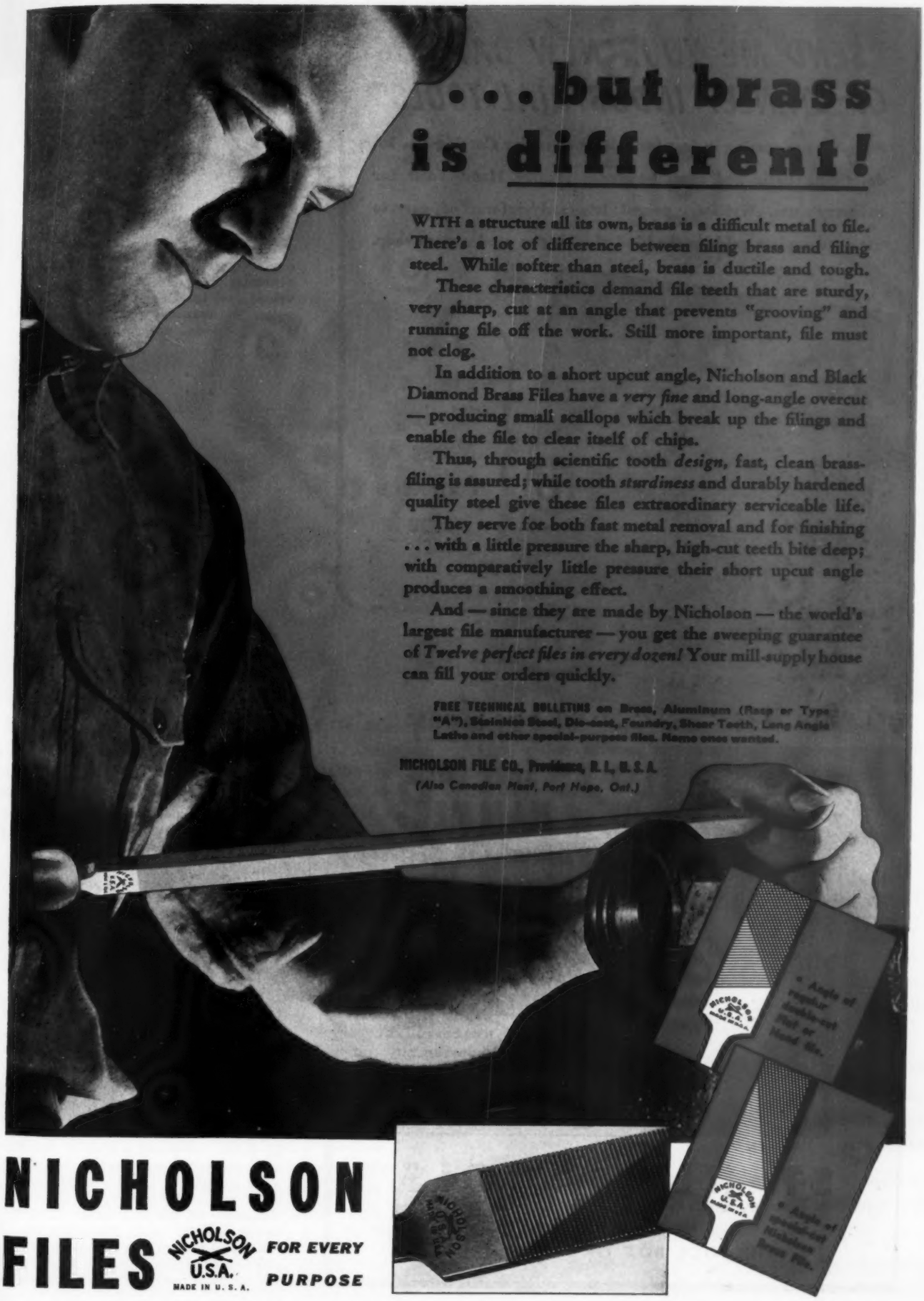
Provides automatic timing control where cycling or sequencing must be controlled in seconds or fractions of seconds. Operating on the electronic principle, it employs a vacuum tube as the essential timing element to eliminate inaccuracies that might develop as a result of wear in gear trains,



cams, etc. Selector knob permits quick setting by dialing. Can be done whether front of timer is open or closed. Range: 1/30 of a second to 120 seconds. Available for 110 or 220 volts, any commercial frequency. Maintaining circuit permits timer to be initiated by momentary touch of the pilot device, otherwise the pilot device must be held closed until the timing has terminated. Measures 8x4x10 inches. Weltronic Corp., 3063 East Outer Drive, Detroit.

Searchlight

For protective lighting. The searchlight is adaptable to systems installed to prevent night sabotage around plants, in railroad yards, construction projects, etc. It



. . . but brass is different!

WITH a structure all its own, brass is a difficult metal to file. There's a lot of difference between filing brass and filing steel. While softer than steel, brass is ductile and tough.

These characteristics demand file teeth that are sturdy, very sharp, cut at an angle that prevents "grooving" and running file off the work. Still more important, file must not clog.

In addition to a short upcut angle, Nicholson and Black Diamond Brass Files have a *very fine* and long-angle overcut — producing small scallops which break up the filings and enable the file to clear itself of chips.

Thus, through scientific tooth *design*, fast, clean brass-filing is assured; while tooth *sturdiness* and durably hardened quality steel give these files extraordinary serviceable life.

They serve for both fast metal removal and for finishing . . . with a little pressure the sharp, high-cut teeth bite deep; with comparatively little pressure their short upcut angle produces a smoothing effect.

And — since they are made by Nicholson — the world's largest file manufacturer — you get the sweeping guarantee of *Twelve perfect files in every dozen!* Your mill-supply house can fill your orders quickly.

FREE TECHNICAL BULLETINS on Brass, Aluminum (Rasp or Type "A"), Stainless Steel, Die-cast, Foundry, Shear Teeth, Long Angle Lathe and other special-purpose files. Name ones wanted.

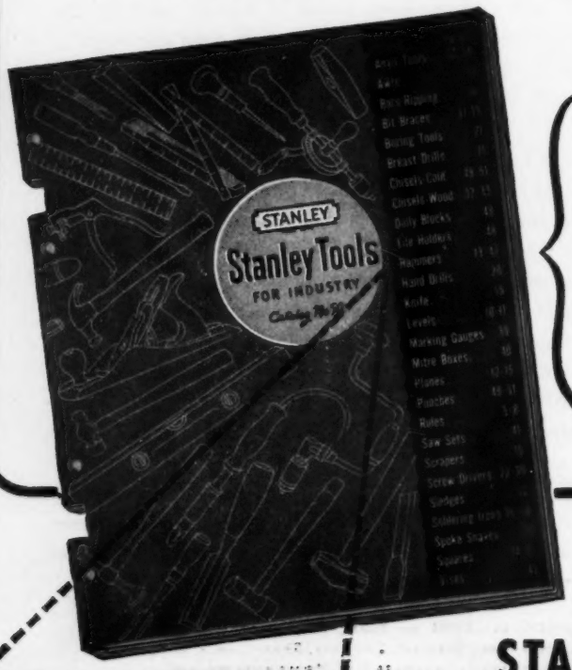
NICHOLSON FILE CO., Providence, R. I., U. S. A.
(Also Canadian Plant, Port Hope, Ont.)

NICHOLSON FILES

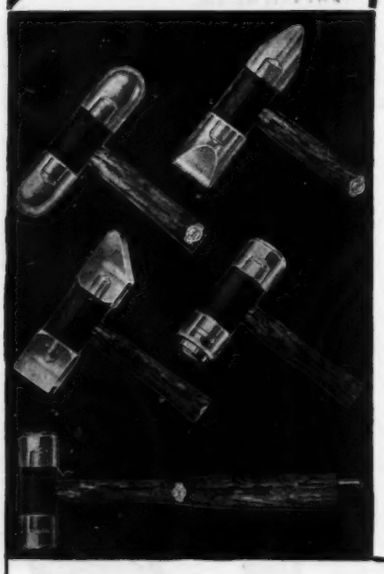
NICHOLSON U.S.A. MADE IN U. S. A. FOR EVERY PURPOSE

"SEND ME YOUR NEW CATALOG OF STANLEY INDUSTRIAL TOOLS"

Requests are coming in fast for this new Stanley Catalog No. 50, describing basic and special-purpose Stanley Hand Tools for industry's use. Write for yours! It's ready-referenced, easy to use – a complete guide to the kind of tools you need in your shop.



Every Index Listing Marks A Complete Line



STANLEY Soft Face HAMMERS

Typical Of Stanley Industrial Tools!

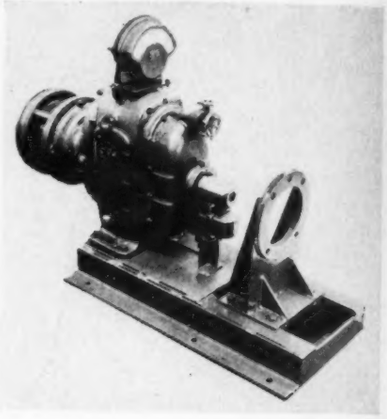
For all kinds of assembly work – light sheet metal forming – aircraft manufacture – these Stanley Soft Face Hammers are ideal. Tips of tough but gentle "Stanloid" composition are easily replaceable. "Evertite" processed hickory handles, with comfortable grips, are securely wedged into steel center body. Your distributor will be glad to supply these tools.

STANLEY TOOLS
DIVISION OF THE STANLEY WORKS
New Britain, Conn.
THE TOOL BOX OF THE WORLD

is an 18-in., 1,000/1,500-watt incandescent lamp; is designated Type S-5; is equipped for pilot-house or hand control; and comes with low or high pedestal. Silvered-glass parabolic reflector provides control of light beam, a spherical auxiliary reflector in front of the lamp eliminates stray light and builds up beam intensity. Casing is sheet aluminum. A door glass clamped over the face makes the unit weatherproof. General Electric Co., Schenectady, N. Y.

Variable-Speed Test Rig

Fully enclosed variable-speed test rig, combining the basic P.I.V. unit and an adjustable mounting bracket on a rigid welded steel base, is applicable in testing generators, magnetos, governors, vibrators, pumps, springs, sewing machines, fuel



pumps, radio generators, tachometers, control governors of diesel railway motors. Various sizes of units can be accommodated. An electric tachometer and calibrated speed indicator driven from the variable-speed shaft provide means for observing exact speed at which the mechanism is being tested. Two controls—direct handwheel control and vernier control through a secondary handwheel. Link-Belt Co., 2045 West Huntington Park Ave., Philadelphia.

Steel Pallets

Three types: double-face, single-face, semi-double face. Features claimed: Rigidity provided by stiffening ribs pressed into the steel, enclosed wire rod at each end, and special formation of corners; weight kept at a minimum; sharp edges and projections eliminated for safety. Truscon Steel Co., Youngstown, Ohio.

Packings

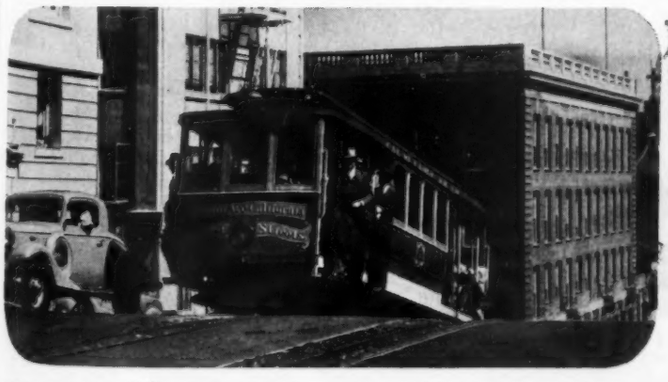
Ameripol, a synthetic rubber, is available in 100-lb. rolls, 36 in. wide, 3/32 to 1/4 in. thick. It provides a sheet packing which resists the action of oils, heat, cold, water absorption. Tensile strength is said to be approximately 1,500 lb. per sq.in., elongation 400 per cent, Shore durometer hardness 78-82.

Koroseal packing, synthetic elastic material, is compounded to resist action of oils, solvents, some corrosives. Tensile strength

IF YOU WANT PROOF--HERE'S PROOF PLUS!

"I'M TOUGH ON MOTORS!" That's what E. H. Humberstone, Superintendent, Marble Cliffs Quarries Co., Columbus, Ohio, says. And he adds — "That's why I use Allis-Chalmers Lo-Maintenance Motors — 187 of them!" Service costs in 15 years on the typical 10-hp Lo-Maintenance Motor shown here driving a screen, have been exactly zero!

MAKES A CYCLONE! Making a man-made cyclone to cool 15,000 gallons of water per minute — that's the job the Panhandle Power & Light Co., Borger, Texas, called upon Allis-Chalmers Motors to perform under weather and operating conditions that would have stumped other motors.



100 HORSES FLATTEN SAN FRANCISCO HILLS Two Allis-Chalmers 300-hp Motors operate San Francisco's historic California Street Cable Car system over hills as steep as 21%. In 26 years of day-after-day service, powering eleven miles of underground cable, there has never been a motor failure!

YOU'LL FIND IT PAYS... For tough jobs or average ones — use the motor that gives performance that's more than just a rated horsepower!

That's why Allis-Chalmers Lo-Maintenance Motors are today so widely accepted by production men who want to take no chances . . . who insist on dependability and long life.

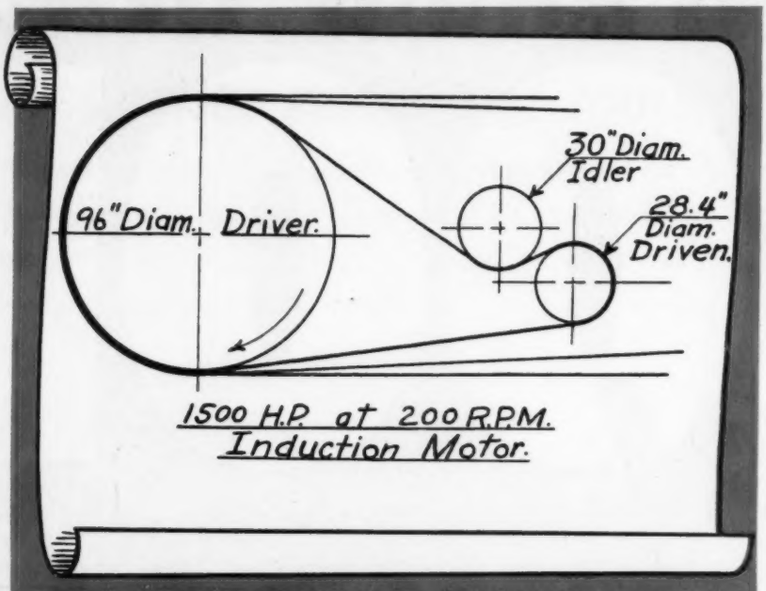
For, in Lo-Maintenance Motors, you get — no skimping anywhere . . . indestructible rotor . . . distortionless stator . . . high carbon steel frame . . . features that give you *positive* assurance of full-measure performance.

See the experienced power engineer in the district office near you for the complete data . . . or write Allis-Chalmers, Milwaukee, Wisconsin.

A 1347

ALLIS-CHALMERS LO-MAINTENANCE MOTORS

A COMPLETE LINE FOR EVERY PURPOSE...ONE-HALF HORSEPOWER AND UP



THIS IS ON A TOUGH STEEL MILL DRIVE

(45" 3 Ply TANNATE on a Morgan mill!)

Says the rolling mill superintendent: "The belt is perking along beautifully and is sure saving me a lot of gray hairs."

TAKE THIS HINT! If you are looking for belting that increases production—and decreases unit cost and maintenance expense—*It's TANNATE!*

Compare relative grip, flexibility, capacity and endurance . . . measure TANNATE leather belting by any exacting yardstick . . . You'll find—as did this mill—TANNATE excels in perfect balance of all properties required to meet today's production needs — efficiently — and with profit to you.

Let's talk about TANNATE in relation to your needs. Write. There is no obligation.

STEP UP PRODUCTION WITH

RHOADS

Founded 1702

Tannate

WATERSHED LEATHER BELTING

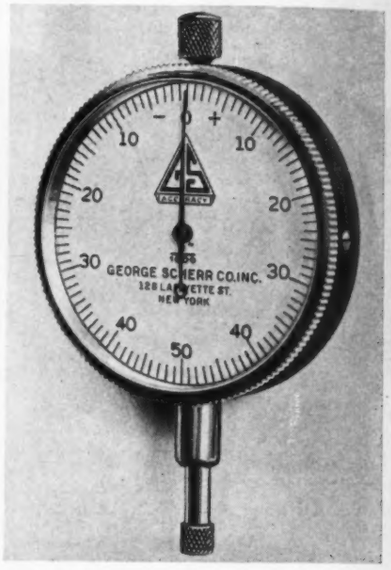
J. E. RHOADS & SONS · 35 N. SIXTH ST., PHILA., PA.

NEW YORK · CHICAGO · ATLANTA · CLEVELAND

is said to be about 2,200 lb. per sq.in., elongation 300 per cent, Shore durometer hardness 73-77. Furnished in 26x26-in. sheets, $\frac{1}{32}$ to $\frac{3}{16}$ in. thick (other thicknesses to order). The B. F. Goodrich Co., Akron.

Dial-Test Indicator

Features a simplified lever movement using a lever arm instead of rotating multiple gear and pinion trains. It is useful in general machine-shop work, tool and die making, lathe and milling machine set-ups, and bench and inspection operations. The



dial is graduated in 1/1,000 in. with a plunger travel of $\frac{1}{16}$ inch. The indicator can be supplied with universal ball joint back permitting wide range of indicator settings on all types of machines. The indicator movement is mounted between separate top and bottom plates and the hair spring is mounted between two flat plates so as not to interfere with the lever rack. The plunger is hardened and ground and has nickel-silver bearing. George Scherr Co., Inc., 128 Lafayette St., New York.

Heavy-Duty Gantry Cranes

Provide auxiliary service beneath box-type mill crane. These gantries are said to operate at 100 ft. per min. from dual drives —steel wheel on the floor rail and Mono-Tractor (rubber wheel) unit on the wall rail. An electric hoist on the crane bridge is propelled by a spur-type MonoTractor for horizontal movement—designed to operate at 350 ft. per min. Controls are located in the gantry cab. Available for handling loads up to 5 tons. The American Monorail Co., 13107 Athens Ave., Cleveland.

Fluorescent Fixtures

G260 and G2603 are for use with 60-in. fluorescent tubes. The reflectors have deep louvers to provide cutoff and are shaped to direct light downward. Top is open to allow illumination of ceiling area, sides

Insulation Facts · Number 1.

Nature does not just "cover" the polar bear. She adequately protects him against the loss of body heat with a coat of efficient insulation.

In industry, where losses from heated piping and equipment give so little evidence of their presence, it is sound practice to specify only those insulations which have a proven record of high performance. For nearly half a century, Ehret's 85% Magnesia has demonstrated its unusually high thermal efficiency in practically every type of industrial service.

In addition to 85% Magnesia, the Ehret Company provides insulation for every industrial requirement, and there are Ehret Contractors or Distributors in all principal cities.

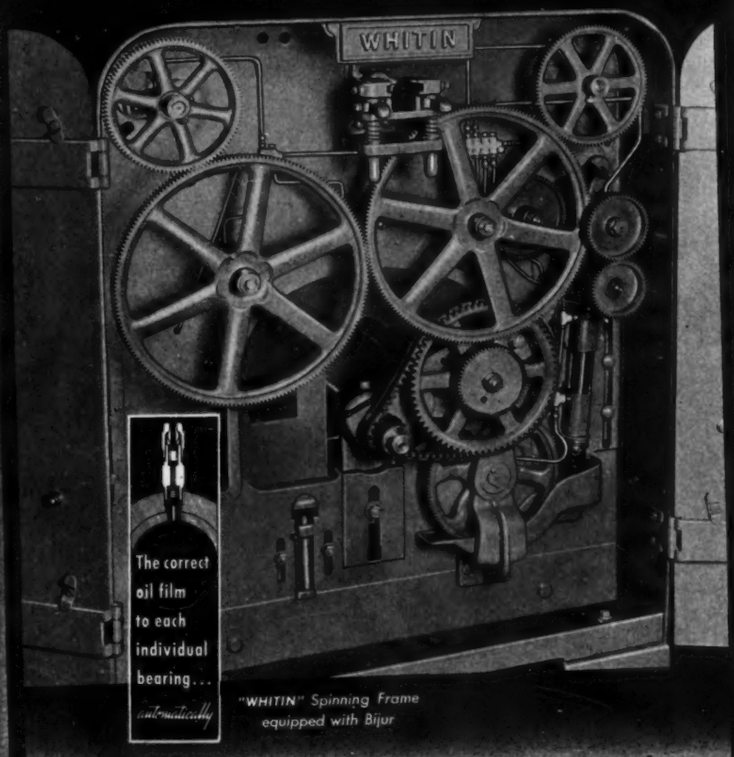
SAVE HEAT WITH EHRET INSULATIONS

EHRET MAGNESIA MANUFACTURING CO.

VALLEY FORGE · PENNSYLVANIA

MAKERS OF INDUSTRIAL INSULATIONS FOR MORE THAN 40 YEARS

"PROGRESS" rewarded



"WHITIN" Spinning Frame equipped with Bijur

● Increased prestige and safer profit margins reward users of *improved* machines . . . Up-to-date plant equipment insures better balance between quantity and quality production. Maximum output necessitates efficient lubrication . . . always. Operation with no disturbing shutdowns . . . correct lubrication with "metered" feed to each bearing, while running.

Specify "BIJUR-EQUIPPED."

BIJUR LUBRICATING CORPORATION • LONG ISLAND CITY, NEW YORK

BIJUR

AUTOMATICALLY *Correct* LUBRICATION

1539

MEMO

CHECK THOSE NEW MACHINE SPECIFICATIONS. THE BEST MAKES HAVE AUTOMATIC LUBRICATION.

1558

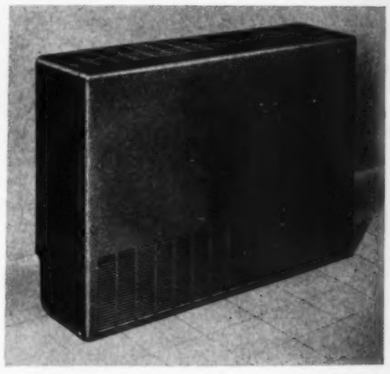
are luminous, interior is finished in white enamel, external metal parts are plated and finished in satin cadmium. May be ceiling or suspension mounted. Lamps may be unlocked and removed through opening in the top without removing plastic or louvers. Ceiling type is made to fit acoustical ceiling blocks. The F. W. Wakefield Brass Co., Vermilion, Ohio.

Automatic Double Reset Timer

Provides time control of the repeat-cycle type and is especially adapted to industrial applications requiring an adjustable and rapidly repeating time cycle. Consists of two reset timer mechanisms mounted on a control panel and controlling common electrical circuits. Furnishing a 10-sec. impulse every 90 sec. for signaling or heating control purposes is a typical application. Operation is continuous and according to sequence determined by settings of timers until external control switch is opened. Furnished for 110 or 220 volts, 50 or 60 cycles; time ranges for each of the individual timers are 15, 30, 60, and 120 sec. maximum. Current-carrying capacity is 10 amp. at 110 volts, 60 cycles. Knockouts for ¾- and ½-in. conduit are provided. The R. W. Cramer Co., Inc., Centerbrook, Conn.

Cabinet Unit Heater

Designed for the heating of offices, lobbies, corridors, wherever quick uniform distribution of heat combined with quiet operation is required. Incorporates blower



fans, motor, and heating coil in one unit and is used in conjunction with a steam or hot-water system. Piping and electrical connections are made within the cabinet. Interior of cabinets is sprayed with a heavy coating of sound-deadening acoustical-mastic. For rust protection, the cabinets are factory bonderized after fabrication. Five types: floor, wall, inverted wall, ceiling, and recessed; three capacities ranging from 105-450 sq.ft. of radiation. Modine Mfg. Co., Racine, Wis.

A. C. Arc Welders

Line of electric welders includes four models with maximum capacities of 75, 150, 200, and 300 amperes. Features: Inclined selector panel for easy selection of heats from an erect position; heavy-duty on-and-off line switch located on selector

5 Reasons Why You Get More Pull for Your Money with *Gilmer* KABLE KORD

On any modern flat drive, if you want to be sure of maximum power transmission at minimum cost, you'll specify Gilmer Kable Kord Belts.

1. **Kable Kord increases production because the upper contactor cords make the pulling cords grip pulleys firmly. There's no slippage and no power wasted.**
2. **Kable Kord's minimum stretch eliminates any need for take-ups, saves time and permits shorter distances between pulley centers.**
3. **Flexibility provides resilience to take starting shocks repeatedly.**
4. **Kable Kord gives longer wear because of its rugged construction and lack of internal friction even at high operating speeds.**
5. **Kable Kord is available either endless or in rolls, and is adapted for use on a great many mill and shop drives, on tractors, etc.**

Take advantage of Gilmer Engineering Service and the complete line of Gilmer Belts to get smoother power transmission, more dependably and at lower cost.

L. H. GILMER COMPANY Tacony, Philadelphia, Pa.

A TRANSMISSION BELT FOR EVERY PURPOSE

THE COMPLETE GILMER LINE—BELTS FOR EVERY DRIVE

V-BELTS for either fractional or multiple horsepower use

STREAMLINER V-BELTING where there are obstructions

KABLE KORD endless and in rolls for flat belt drives

CD AND CUT EDGE FLAT BELTS for f.h.p. duty and on small machinery

RH AND RHO BELTS for lathes, grinders and milling machinery

ROUND BELTS AND BELTING for serpentine, crossed or light mule drives

SPEEDAGE ENDLESS BELTS of woven fabric for high speed work around 10,000 f.p.m.

#99 and #1010 SPLICED ENDLESS BELTS for light grinders, routers, drill presses, etc.

SPLICED ENDLESS SOLID WOVEN BELTS AND BELTING for light conveyors and light duty transmission

BAND SAW BANDS used in woodworking

SPINNER AND TWISTER BELTS used in the textile industry for spindle drives

PLANER BELTS for heavy duty lumber and woodworking equipment

GAINER, CONE AND LICKERIN BELTS for textile throwers, lickerins and spindles

PRINTERS' TAPE AND MIEHLE PRESS BELTS for printing press and paper converting equipment

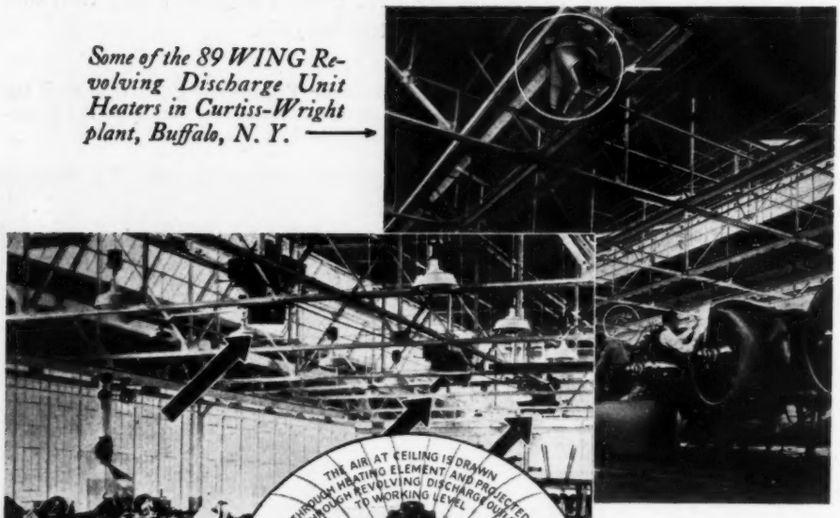
LAUNDRY FEED RIBBONS for conveying laundry flat work

COTTON DUCK AND ENROBER BELTS for light conveyors in bakeries, candy factories, etc.

TUBE WINDER BELTS for turning paper tubes of all sizes in the container industry

All Industry is Talking WINGS

Some of the 89 WING Revolving Discharge Unit Heaters in Curtiss-Wright plant, Buffalo, N. Y. →



THE AIR AT CEILING IS DRAWN THROUGH HEATING ELEMENT AND PROJECTED THROUGH REVOLVING DISCHARGE OUTLETS TO WORKING LEVEL
WING
DISCHARGE-OUTLETS-REVOLVE-SLOWLY

View of WING Revolving Discharge Heaters in one of the United Aircraft Company's Hartford, Conn., plants; a total of 92 WING Revolving Heaters in all the Hartford and E. Hartford plants.

WORKERS who turn out planes, engines and parts for America's "Wings of Defense," work with increased efficiency and comfort when the air feels "alive and invigorating"... as it always does in factories properly heated by Unit Heaters with discharge outlets that slowly revolve . . . as only WING Unit Heaters do.

Write for the story of unprecedented heat distribution. Ask for WING Bulletin H-8.

L. J. WING MFG. CO., 154-F W. 14TH STREET, NEW YORK, N.Y.

WING REVOLVING DISCHARGE UNIT HEATERS

UNIT HEATERS • VENTILATING FANS • EXHAUSTERS • BLOWERS • TURBINES

panel; drip-proof storage space between selector panel and cabinet front for accessories; ventilating louvers on top and sides; no moving parts; transformer coils wound with copper magnet wire having double-spun glass insulation that withstands temperatures in excess of 1,000 deg. F. and is impervious to moisture, grease, acid. The Emerson Electric Mfg. Co., St. Louis.

Unbreakable Thermal Oiler

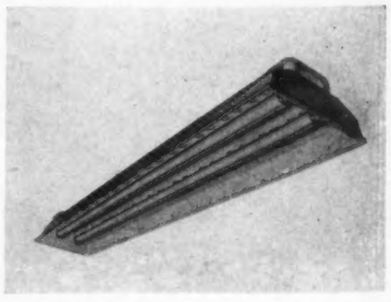
Visible unbreakable bottle oiler lubricates solid, wick, or waste-packed bearings automatically. On a slight temperature rise the oiler discharges a few drops of oil. The bearing receives it, cools, and the feeding stops of itself. Through the adjustable feed, the flow of oil may be regulated. Available in 1-, 2-, and 4-oz. capacities. Trico Fuse Mfg. Co., 2948 North 5th St., Milwaukee.

Flat-Spray Nozzles

Spray pattern of the nozzle is flat with slightly heavy center at higher pressures and can be had in a number of different spray angles. Nozzles are available in ⅛- to ½-in. male pipe connection. Capacities: 0.5 to 10 g.p.m. at 10 lb. pressure and 1-20 g.p.m. at 40 lb. pressure. Available in brass or all iron (other materials specified). For use in processing, washing machines, where sprays are overlapping each other. Spraying Systems Co., 4021-D West Lake St., Chicago.

Fluorescent Lighting Unit

Stream-Flo 60 has been designed to accommodate two 60-in., 100-watt, "white" fluorescent lamps with 3,500 deg. Kelvin rating equal to a "daylight" incandescent lamp in color temperature. Apertures at



the top are said to allow approximately 2½ percent of light output to pass upward to relieve contrast between lighted areas of the room and ceiling background and thus extend the use of fluorescent lighting to higher levels. May also be had without the apertures in the top. Protection against glare is provided by a shielding angle of 14 deg. and closed-end reflector. The unit is said to have a reflection factor of 79 percent or more. Benjamin Electric Mfg. Co., Des Plaines, Ill.

Vertical Explosion-Proof Motor

Designed for class I Group D applications where flammable volatile liquids, highly flammable gases, mixtures or other highly flammable substances are present;

in Class II Group G locations in which combustible dust is present as in flour or feed mills, grain elevators, starch plants, sugar, cocoa and coal pulverizing plants. Unit is fan cooled, has asbestos protected windings. Available with a variety of mounting flanges and a mounting bracket to fit it without additional adaptors or plates. U. S. Electrical Motors, Department 63, 80—34th St., Brooklyn, N. Y.

Infra-Red Lamp Reflector

Model QR is designed to eliminate any chance of loss of heat in infra-red baking tunnels. It is hexagonal in shape thus making it possible to obtain an enclosed-

type tunnel with the reflectors "nesting" close together in multiple-assembly installation. Measures 10¼ in. diameter and is available in single units or in multiple assemblies. Smaller model, QM, is 7⅝ in. diameter. The Fostoria Pressed Steel Corp., Fostoria, Ohio.

Floor Machine

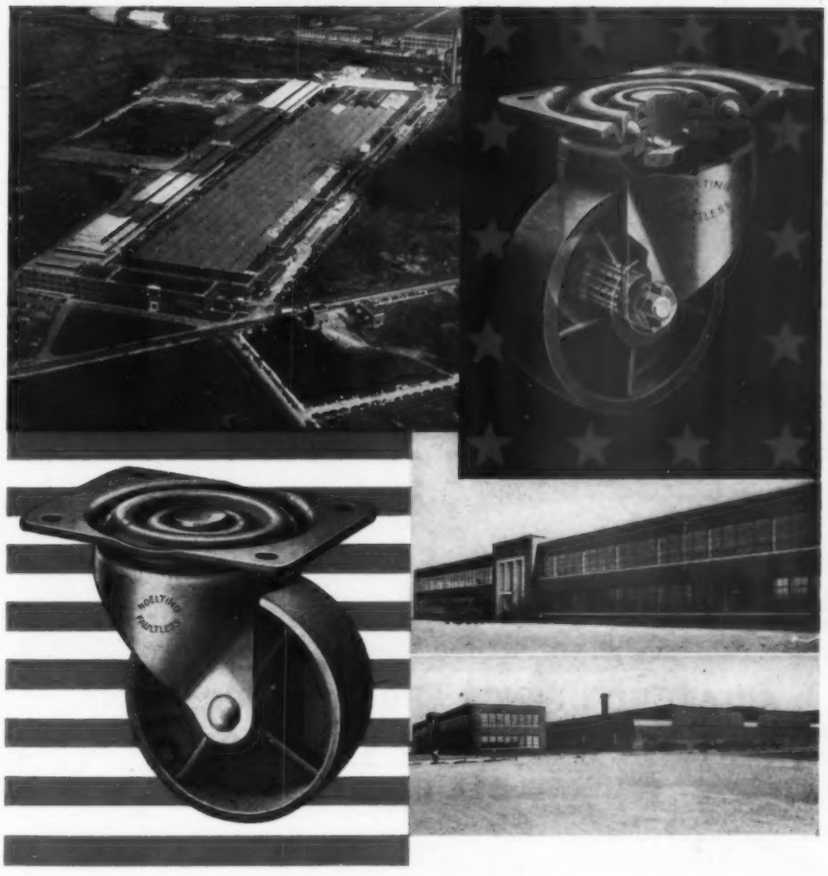
Designed to maintain a smooth bright finish on plant and office floors of wood, asphalt tile or mastic, concrete, the machine may also be used as a sander for reconditioning old wood floors and for smoothing down new floors. It eliminates the use of soap and water. Equipped with a steel wire brush, it removes lubricating oil, steel chips, and other heavy spillage. Dirt is picked up by a power vacuum and collector pan. Using a roll of steel wool, the machine buffs the floors to a wax-like finish. G. H. Tennant Co., 2530 North 2d St., Minneapolis.

Temperature Indicator

For those who need a portable instrument for thermocouple temperature measurements, for checking thermocouples, or for measuring small e.m.f. Increased accuracy has been provided, it is said, by calibrating only a small portion of the range on a continuously adjustable slidewire. The remainder, adjustable in fixed steps, is on a dial switch of ten resistors. Range: O to 111 millivolts with a limit of error of ±0.1 millivolt. Built into it are battery rheostats, pointer galvanometer, standard

FAULTLESS CASTERS

do their bit in National Defense Plants



National defense puts a new premium on plant efficiency . . . an urgent demand for elimination of weak links in the production chain! Here, in these and other key plants, Faultless Industrial Casters are assigned the job of keeping assembly lines and units moving on precise schedules. Because in both the 100 and 200 Series Casters illustrated are features of design, material and workmanship which are inherent guarantees of dependable service. Faultless Industrial Casters offer a sturdy defense against production breakdowns and delays. Their record in thousands of installations is concrete evidence of their ability to cut transportation costs, save time and workers' energy. The Faultless line is completely rounded out—from the Dreadnaught with 3,000 lbs. capacity to small casters for light duty. There's not the slightest obligation in asking to see how Faultless Casters will strengthen *your* production program.

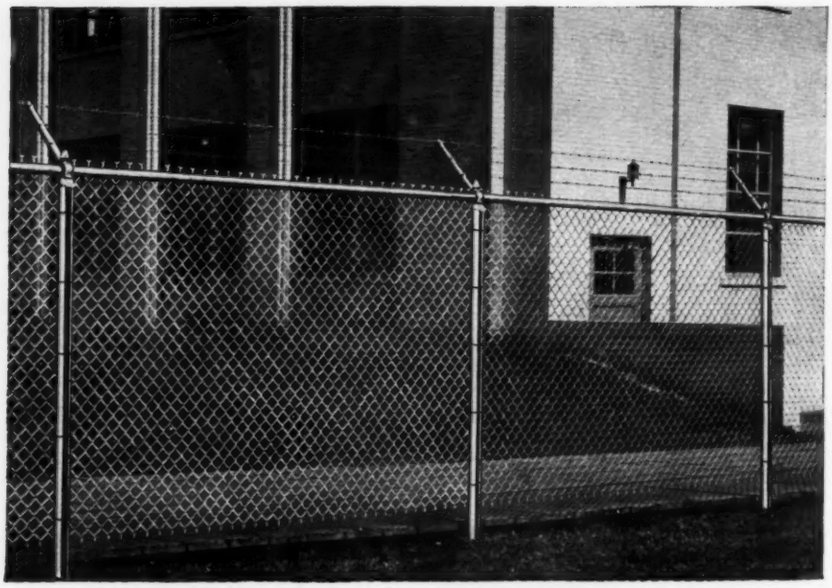
FAULTLESS CASTER CORPORATION

Dept. FM-3, Evansville, Ind.

Branches in Principal Cities. Canadian Factory: Stratford, Ontario

FAULTLESS CASTERS FOR INDUSTRY

Government Contract Work
Demands Protection
"Outside and Inside" Your Plant



AN ANCHOR FENCE AROUND YOUR PLANT, PLUS ENCLOSURES INSIDE, GIVES COMPLETE PROTECTION

The moment you secure a Government Defense Contract—your plant and personnel are subject to danger from saboteurs and spies who are intent on destroying or hindering all Defense orders. Perhaps you've already installed a fence—to give you complete protection from outside sabotage agencies. But wartime conditions make it vital to raise similar impenetrable barriers *inside* your plant property—around power stations, transformer installations, chemical storage, fuel supply to make definitely certain that only specially selected employees can reach these and other vulnerable points in your plant. Remember, there may be potential saboteurs on your payroll right now!

Anchor Fences can be Moved in Case of Plant Expansion

An Anchor Fence can be quickly installed, yet can be moved without loss in case of plant expansion. Send for the Anchor Engineer. He'll give you the benefits of Anchor's long experience in fence protection. Show you how to secure complete protection outside and inside your plant with a minimum of expense for guards.

AN ANCHOR FENCE ENGINEER will gladly help you plan complete protection for your plant. Write or wire today to: ANCHOR POST FENCE CO., 6620 Eastern Ave., Baltimore, Md.

cell, battery, galvanometer key, and standardizing key. Only additional accessories required are the thermocouple and an ice bath for the reference junction. Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia.

Sump Pump

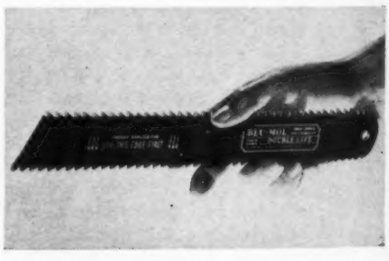
Line of "floatless" sump pumps, said to handle up to twice the volume ordinarily handled by pumps of this type, features a forged impeller, the Power-Peller. They have the following advantages: rust-resistant copper, brass, and bronze construction; automatic circuit breaker incorporated within the electric motor; water-lubricated bronze bearings. Motors are ¾ hp. and operate on 110 volts, 60 cycles, a.c. (220 volts available). Capacities range from 3,650 g.p.h. at 5 ft. total head to 500 g.p.h. at 24 ft. total head. The Imperial Brass Mfg. Co., 1200 West Harrison St., Chicago.

Detachable Sheaves for V-Belt Drives

Type Q-D quick-detachable and quick-demountable sheaves are available in complete range of standard driver sizes in the company's Multi-V-Drive line. Said to be suitable for any application where quick mounting of sheave to shaft and dismounting from shaft are desirable—where speed ratios must be changed to meet varying conditions as on fans, blowers, printing presses, machine tools, special equipment. Worthington Pump & Machinery Corp., Harrison, N. J.

Two-Edged Saw

A high-speed molybdenum hack-saw features a set of teeth on both edges to pro-



vide double cutting life. The teeth of the first edge have a fractionally wider set than those of the second edge. Available in sizes 12-24 in. long, 1-2 in. wide. Millers Falls Co., Greenfield, Mass.

Weld Controller

Weld Timer-Contactor, Model 108-53, to be used with any 15-35 kva. manually or mechanically timed spot welder, is available for 220, 440, or 550 volts; 25, 40, 50 or 60 cycles. It is adjustable from 2-30 cycles. Two control knobs provide adjustment to suit work being welded. High-speed heavy-duty welding contactor is used. Contactor and relay contacts are removable for re-

THIS ASSEMBLY LINE LUBRICATION JOB NOW DONE IN 1/10 FORMER TIME!

SAYS WARNER-SWASEY CO.

Famous Turret Lathe Manufacturers Have Turned to Alemite Power Guns As Best Answer to Assembly Problems

SAYS Warner-Swasey's Foreman Steve Stofko, "When we put a Warner-Swasey Turret Lathe together, it must be ready to go to work for the purchaser. That means *a thoroughly dependable lubrication job* during assembly. If we can do it fast, that helps, too. Our Alemite Power Gun gives us the dependability we must have—in about one-tenth the time formerly required to do the same job!"

In the early stages of their development, Warner-Swasey used Alemite Hand Guns for this work. Then, as production increased, they put in an Alemite "Rock Crusher" Power Gun. Now, with demands stepped up by many customers who are involved in the national defense program, they are making full use of the big Alemite Power Gun shown above, which operates direct from original 400-pound grease drums.

Whatever the lubrication demands of your plant, it will pay you *to investigate the time-saving capacity* of Alemite Power Lubrication —with due attention to cleanliness, dependability, and lower maintenance costs. Write to us on your letterhead!

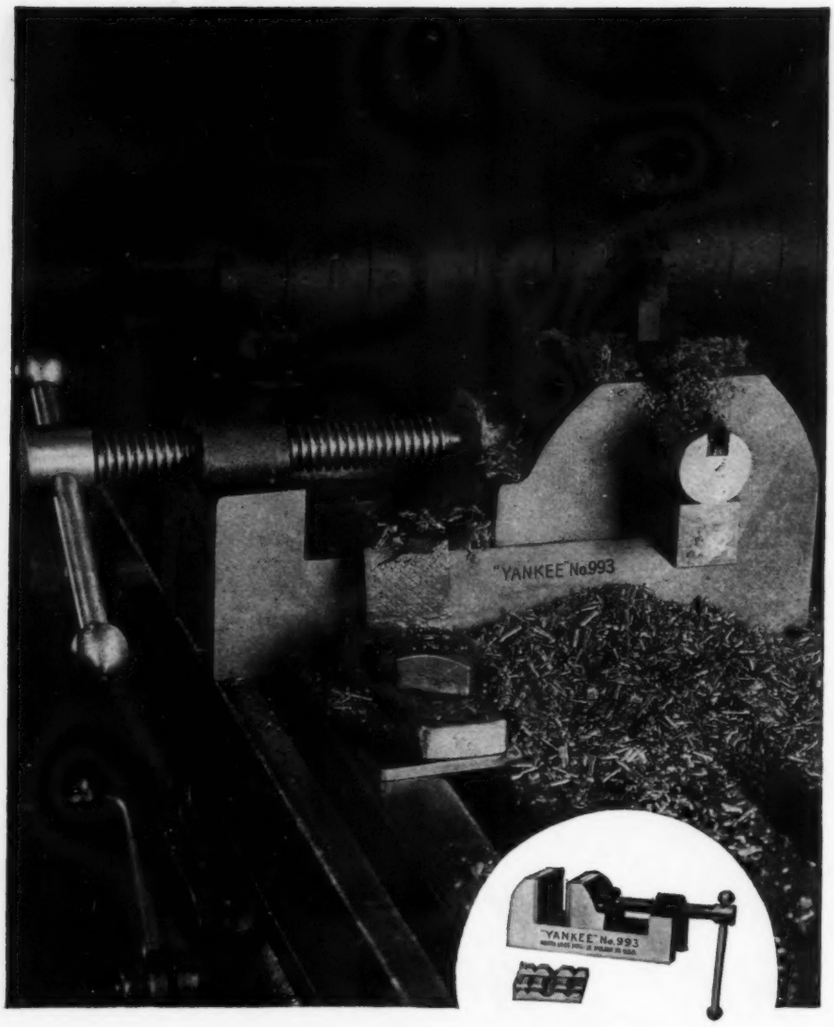
ALEMITE

REG. U.S. PAT. OFF.

Industrial LUBRICATION

ANOTHER STEWART-WARNER PRODUCT

1870 Diversey Parkway, Chicago, Illinois • Belleville, Ontario



"YANKEE" VISE
SPEEDS PRODUCTION

"Yankee" is a *fast-production* vise—different from any other vise in your shop! Squared all sides. Designed for continuous work—from bench to machine and back again—accurate results and no delay. "Yankee" Vise illustrated above, made in four sizes: No. 991, 1½" jaw width. No. 992, 2" jaw width. No. 993, 2¾" jaw width. No. 994, 4" jaw width. Hardened steel block, V-grooved, supplied for holding rounds.

"Yankee" Vise also available with removable swivel base. Sizes, Nos. 1991, 1992, 1993 and 1994.

ORDER FROM YOUR SUPPLY HOUSE. FOR "YANKEE" VISE CIRCULAR, WRITE NORTH BROS. MFG. CO., DEPT. F. PHILADELPHIA, U. S. A.

NORTH BROS. MFG. CO., PHILADELPHIA, U.S.A.

placement. Entire unit consists of an electronic tube, relay, and magnetic contactor enclosed in a case measuring approximately 11x13x30 inches. May be mounted on the welder, a wall, or stand. Weltronic Corp., 3063 East Outer Drive, Detroit.

Down-Flow Unit Heaters

Used at high ceiling heights, the heaters force warm air down to the working zone. They operate on steam or forced hot-water circulation, are available in a wide range of sizes and capacities, can be supplied with variable-speed motors. The heater is set in a round steel casing. McQuay, Inc., 1620 Broadway St., N.E., Minneapolis.

Die Trucks

Rate of rise of table is 16 in. per min. at 120 r.p.m. Type B-1 handles dies up to 40 in. long, size of table is 28x40 in.,

safe table load is 3,000 lb., safe load overhead is 1,600 pounds. B-2 handles dies up to 32 in. long, safe load of table is 2,000 lb., safe load overhead is 1,600 pounds. Both are equipped with ball-bearing heavy-duty casters, rubber-cushioned. O. Johnson Co., Brookfield, Ill.

Heat-Treating Furnaces

Nos. 70 and 120 are available in bench and pedestal style. They are for heat treating high-speed steels; are useful for high-carbon steels; for hardening punches, dies, parts, and cutting tools. Carborundum hearths are standard equipment with burner flame below the hearth. Line of pot-hardening and melting furnaces for case hardening, tempering, carburizing, pearlitonizing and melting non-ferrous metals is also available. The Johnson Gas Appliance Co., Cedar Rapids, Iowa.

Recycling Control

Recycling control, for attachment on meters used for initiation of automatic processes, is constructed so that when a predetermined quantity of water has passed through the meter a contact will be made which will initiate the automatic cycle after which this meter control resets itself

33 REASONS WHY You're Assured BEST POSSIBLE RESULTS when you specify BENJAMIN FLUORESCENT LIGHTING UNITS

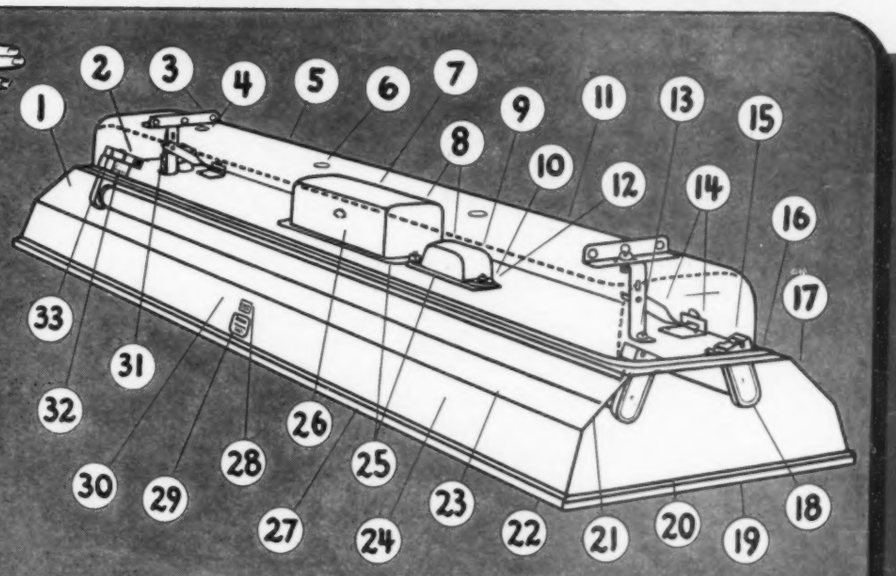
EVERY ONE OF THESE 33 "STREAM-FLO" FEATURES IS ESSENTIAL TO:

1. Lighting performance

that meets the high standards established by Benjamin, the RLM Standards Institute and the requirements of the Science of Seeing.

2. Durability

that meets the Benjamin standards for heavy duty service. Built like a *Battleship* to insure long life efficiency, lowest operating and maintenance costs and greatest freedom from service interruptions.



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To Solve Your Defense Production Lighting Problems... AT YOUR SERVICE ARE *Benjamin Distributors*, skilled in applying the most approved lighting practice to specific problems—*Benjamin's Engineering Department*, recognized as one of the most experienced in the industry—*Benjamin's manufacturing capacity*, largest in the industrial lighting equipment field—*Benjamin's complete line of lighting equipment*, the result of 40 years of specialization in the design and manufacture of lighting equipment for practically every industrial requirement . . . Fluorescent, Incandescent, Mercury.

BENJAMIN IS READY TO MEET YOUR EMERGENCY REQUIREMENTS . . . ready to give you the lighting recommendations and the delivery service you require. Call on Benjamin.

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These 33 Features of Benjamin RLM "Stream-Flo" Units enable you to economically increase Seeing Efficiency and Production

NEVER in our history has it been so important that immediate steps be taken to increase the *Speed and Ease of Seeing* so as to improve production, increase accuracy of workmanship, safety and all-round employee efficiency. Never before has there been available, in such a period as this, a tool so admirably adapted to this purpose as the cool, economical, Daylight lighting provided by Benjamin Fluorescent Lighting Equipment.

These 33 features built into Benjamin RLM "Stream-Flo" Units indicate the thoroughness with which all Benjamin Fluorescent Lighting Units are engineered and constructed. In these 33 features you will find the evidence of engineering leadership which has made Benjamin the leading maker of lighting equipment for industrial and commercial use.

It will be to your interest to write now for a copy of the new Benjamin Manual on Fluorescent Lighting containing the data sheet detailing each of the 33 "Stream-Flo" features and complete information about all other Benjamin Fluorescent Units. This Manual will give you the facts which are leading more industrial concerns, consulting engineers and others to specify Benjamin equipment than any other. Address the Benjamin Electric Mfg. Co., Dept. N, Des Plaines, Illinois.

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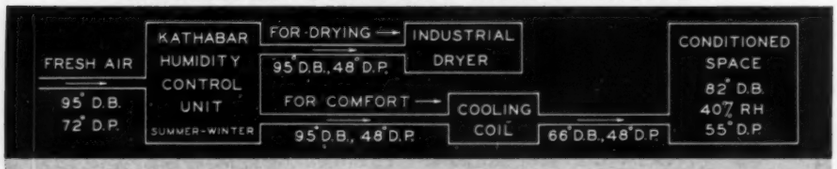
KATHABAR STRAIGHT-LINE PRINCIPLE



● Kathabar creates the desired humidity first, without changing temperature—*as the outside air enters the building.* All that is necessary thereafter is to cool or heat the air to desired temperature. No over-cooling, re-heating or by-passing. With Kathabar humidity is handled entirely independently of temperature, with easy precision and economy. Kathabar employs no toxic, explosive, or dangerous gases or liquids.

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● FOR CONTROLLED DRYING — where materials and their by-products must be dried under controlled conditions.

● FOR SPECIAL ATMOSPHERES — industries where air conditions affect materials, processes and products.

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ALSO MANUFACTURERS OF
SC INDUSTRIAL FURNACES, JANITROL GAS-FIRED DOMESTIC AND COMMERCIAL HEATING EQUIPMENT

and is automatically ready to measure the predetermined quantity of water before the next cycle is started. Features: Mercury switches, no electrical current-carrying parts on the dial, adjustment of quantity of water passing through meter between cycles by a dial visible through the glass face. The Permutit Co., 330 West 42d St., New York.

Manual Control Switch

Heavy-duty control switch suitable for operation by foot, knee, elbow, or hand pressure is 4 in. diameter by 2⅛ in. high. Two models: One that weighs 3 lb. is designed so that a light touch will not cause contact; the other, weighing 1½ lb., responds to a light touch. Three types: single pole, normally open; single pole, normally closed; single pole, double throw. General Control Co., Cambridge, Mass.

Automatic Water Drain

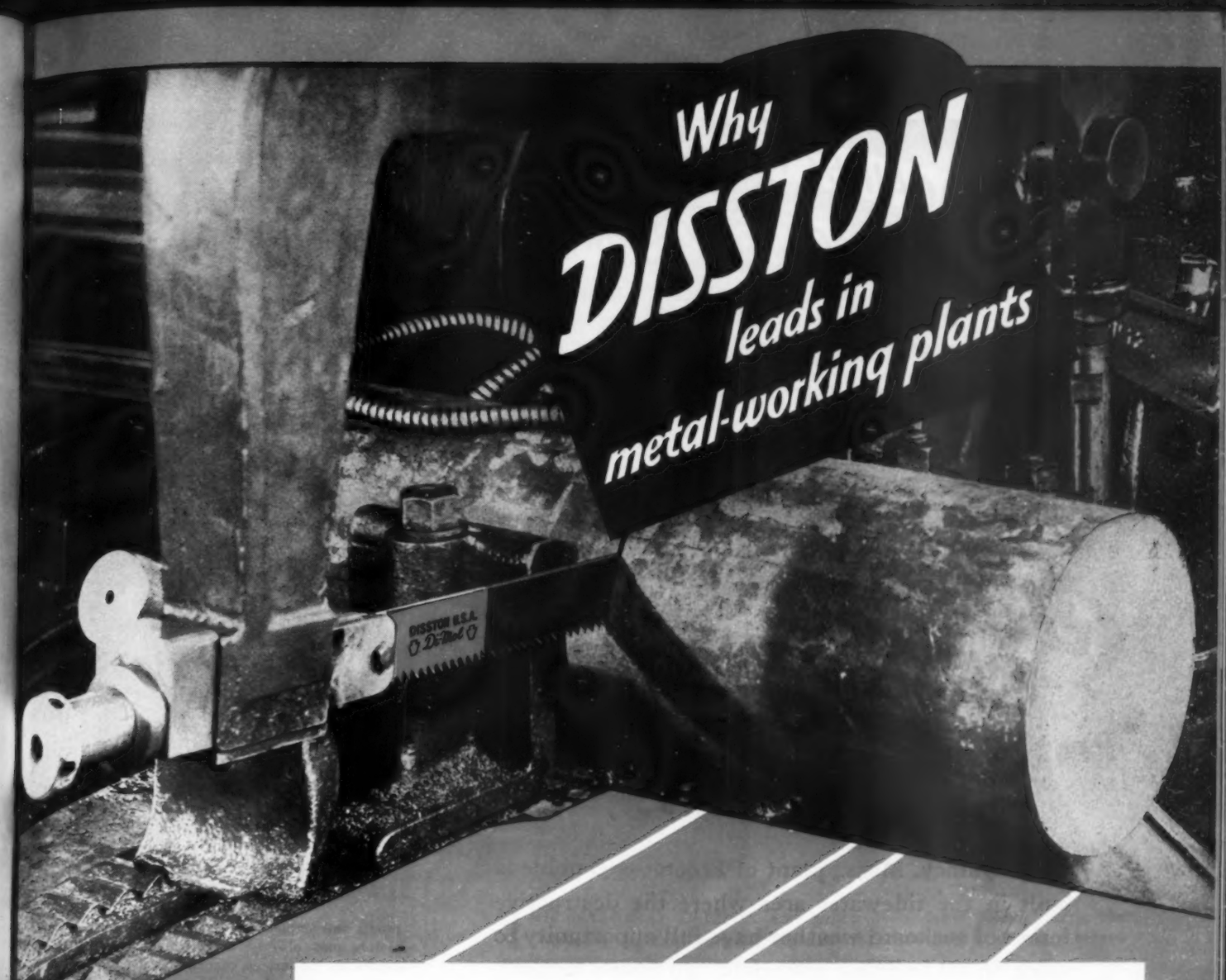
For use in compressed air lines, the Type HOD water drain is available with four fitting assemblies and is intended for installation in air lines, on air-compressing outfits, or air receivers (especially useful in spray painting). Draining the air line or receiver automatically, it prevents water from being carried into the tool used and thereby prevents rusting and corroding and assures a supply of moisture-free air. A variation in the main line air pressure of 5 lb. is sufficient for its operation. The DeVilbiss Co., Toledo.

Electrical Connector

Type EA Versilug features a rotatable cable clamp permitting conductors to be joined to the connectors at any angle. Available in six sizes to accommodate a range of conductors from No. 8 stranded cable to 1,000 MCM. The connector body is made of high-conductivity copper alloy, the clamping eye of high-strength bronze. Everdur bolts are used, there are no exposed threads. Burndy Engineering Co., Inc., 459 East 133d St., New York.

Controller

Solu-Bridge controller automatically warns of the presence of excessive carry-over in boiler condensate by actuating an external warning device such as a lamp,



It's a leadership that begins where white-hot steel is poured from the modern Disston electric furnaces. It continues through the up-to-date plant where Disston saws, files and other products are manufactured by skilled craftsmen. It's backed up by Disston Engineering Service—experts aiding in the efficient application of tools and steels to increase production and cut costs.

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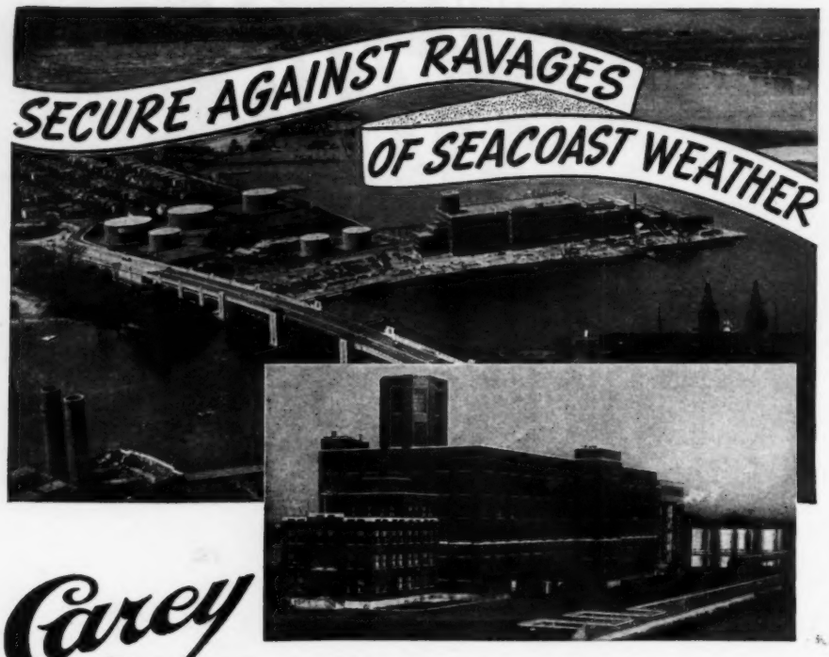
Write or wire us for complete information today. HENRY DISSTON & SONS, INC., Philadelphia, Pa., U. S. A.



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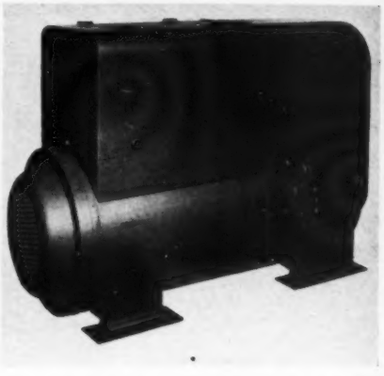
bell, or recorder. Can be applied to the operation of an electro-magnetic valve or other mechanical device. It handles both analytical and control functions. One dial is set at approximately the temperature of the condensate. The main dial knob is then turned and the percentage of carry-over present is read directly off the dial. Also the controller will open or close its relay contacts for controlling an external circuit at whatever reading the main dial is set. Experience is not required to operate the Solu-Bridge. Industrial Instruments, Inc., 156 Culver Avenue, Jersey City, N. J.

Adjustable-Speed Units

All-electric a.c. adjustable-speed drive is now available in 20-, 25-, and 30-hp. sizes. The units are horizontally mounted. Mounting brackets contain longitudinal rubber shock pads to insure quiet operation. The driving motor can be supplied in various types including enclosed fan-cooled, splash-



proof, and explosion-proof models. Gearmotors may also be used. May be connected to the driven machine by any one of the usual methods. Features claimed: Motor can be started and stopped without interfering with the speed setting, speed can be changed while the motor is in operation, stopping is by regenerative braking, no clutches are needed since ample torque with controlled acceleration has been provided for all starting conditions. The Reliance Electric & Engineering Co., 1088 Ivanhoe Road, Cleveland.

Fluorescent Luminaire

The Excelux produces semi-indirect lighting. Full-screened lamp diffusion is effected with a glass or plastic lamp shield to minimize harsh glare and together with glass end-windows provides even distribution of light. Uses four 40-watt lamps and is available for close-ceiling or suspended mounting. Edwin F. Guth Co., 2615 Washington Blvd., St. Louis.

Iron-Body Wedge Gate Valves

Line of valves for 125 lb. steam, 200 lb. cold working pressure includes the brass-trimmed and the all-iron patterns with outside screw and yoke or non-rising stem in sizes 2-12 inches. Also the quick-opening and the Underwriters' patterns, and the alloy-trimmed alloy cast-iron valves for

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In many plants the heavy overhead cranes are often held up for long periods by light local handling jobs — such as fitting and assembling the various parts of a machine-tool.

With one or more Cleveland Tramrail Single-leg Gantry Cranes operating underneath, the overhead cranes are relieved of this work, and are free to handle the heavy completed machines and other heavy loads. Gantry cranes greatly reduce waiting time and cut production delays.

Many manufacturers are effecting real savings, both in capital expenditure and operating cost, through use of single-leg gantry cranes. Where two or three costly overhead cranes would ordinarily be required, only one now is used with several inexpensive gantry cranes.

Because of anti-friction bearing wheels and many other features, all Cleveland Tramrail materials-handling equipment is unusually smooth and easy operating. Only 15 pounds starting effort and 10 pounds running effort is needed to move a ton load on the runway.

Single-leg gantry cranes may be obtained for hand operation, or with any or all motions motorized.

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This illustrated booklet gives a clear concise understanding of overhead materials handling. It helps you determine where and what equipment might be used to speed production and increase profits. Write for Booklet 2004-A on your company letterhead.

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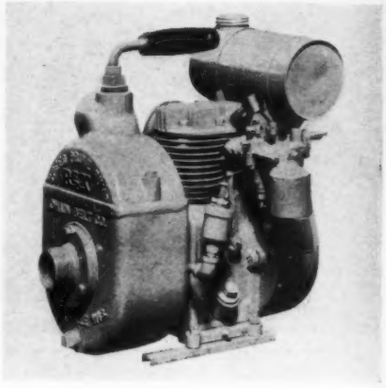
process work. Features: malleable-iron handwheels, deep stuffing boxes, shoulder-type seat rings. Crane Co., 836 South Michigan Ave., Chicago.

Welding Gage

Facilitates calibration of butt- and fillet-type welds—convex fillet welds, tolerances of convexity, concave fillet welds, butt-weld reinforcements. The gage is pocket size and is made of chromium-plated steel. The Chicago Tool & Engineering Co., 8389 South Chicago Ave., Chicago.

Portable Centrifugal Pump

Light-weight 1½-in. centrifugal pump weighs 54 lb. and has a capacity of 3,000 g.p.h. Its design includes the Rex Peeler that "peels" the air from the whirling impeller to speed up the prime, a semi-



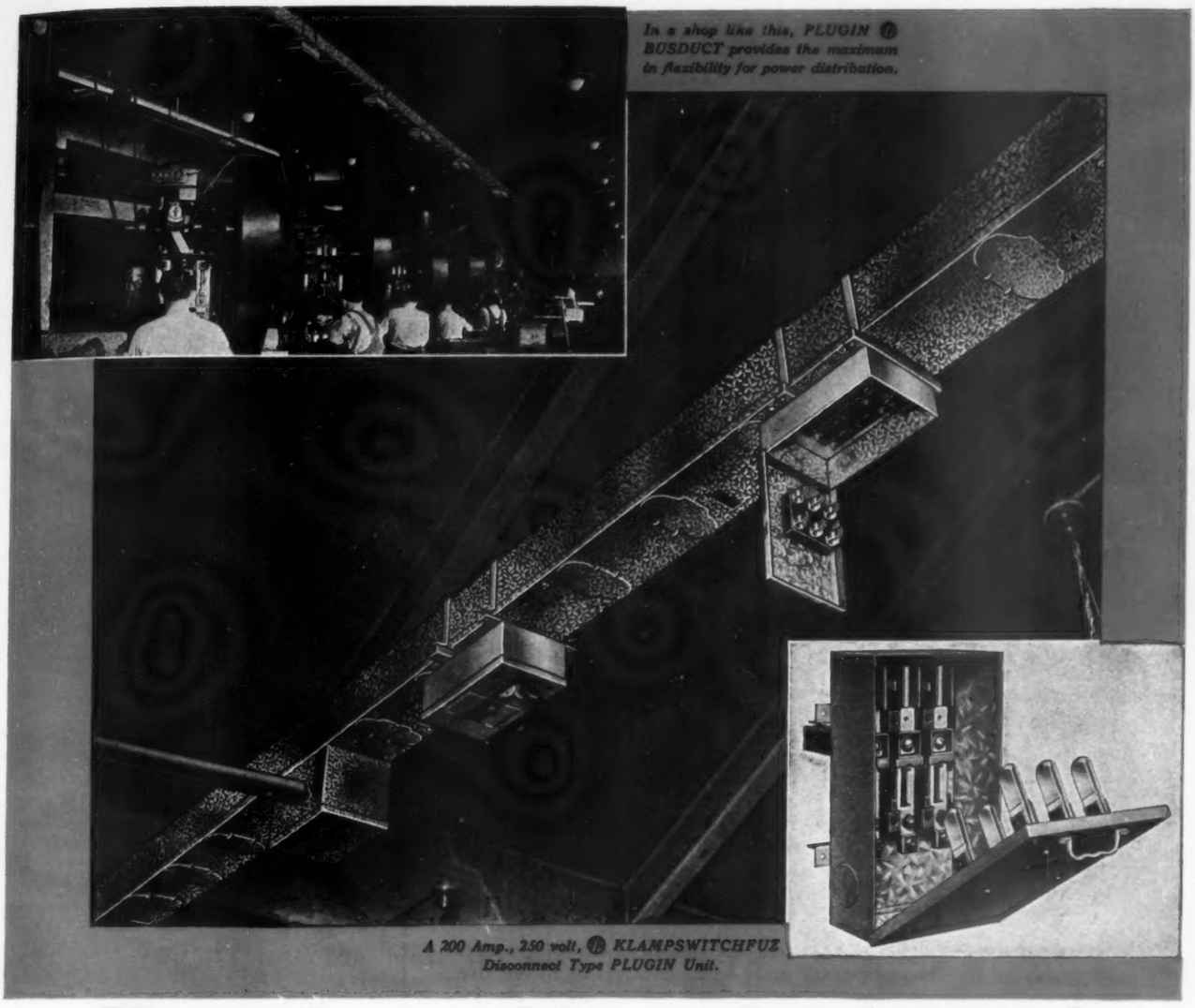
steel recirculating water chamber equipped with an aluminum cap, a single-cylinder air-cooled engine—¾ to one horsepower. The engine is equipped with an automatic governor that speeds up the motor when the pump catches its prime and starts to lift water. (Eliminates possibility of putting too much strain on the power unit at low speeds.) Chain Belt Co., Milwaukee.

Lamp Socket

The Swivelier is said to have the following advantages: It is adjustable to 90 deg., can be rotated 360 deg. when adjusted at any angle, has stop that prevents wires from twisting, will stay put in any position, will not work loose from vibration, has no exposed wires. It can be attached to a rod which may be attached to a lathe, drill press, or other machinery. Reliance Devices Co., 140 Liberty St., New York.

Self-Contained Lubricating Units

Contain all the equipment necessary for lubrication in one unit so that all that is necessary to put the unit into operation is to hook up the pipe lines and wiring. The units are available in a variety of sizes for lubricating mill drives, hydraulic pumps, industrial machinery. They store, pump,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It's as simple as that when the plant is equipped with Plugin (FA) Busducts. The easily-accessible outlets, conveniently spaced, make it possible to place machines at any desired location — to plug in quickly—and to commence operation without delay. With Plugin (FA) Busducts, use Feeder (FA) Busduct to provide ample capacity for present and future power requirements.

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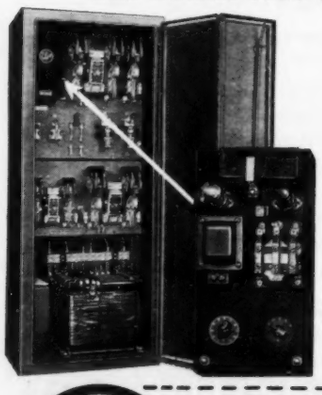
ABOVE you see an EC&M NEO-TIME unit which operates the distributor-top of a blast furnace—stopping it at any selected position.

It controls the length of time for application of power, allowing the motor to operate only long enough to move the top from one position to the next. And it is *mounted at the ground level*—hence, readily accessible.

What a remarkable improvement over the former method whereby the motor was stopped by limit switches attached to the mechanism *at the top of the blast furnace,* requiring frequent inspection and maintenance in this dangerous area.

The EC&M NEO-TIME unit has numerous applications in industry. It's a simple, flexible method for (1) timing acceleration of A-c and D-c motor control and (2) timing application of D-c field on synchronous motors as well as for standard timing problems. Simply turning a dial changes the timing interval. Booklet 88 shows typical applications of NEO-TIMED motor control. Ask for a copy. The Electric Controller & Mfg. Co., Cleveland, Ohio.



EC&M 125 HP Motor Starter with NEO-TIME acceleration

Please send Booklet 88 showing NEO-TIMED Motor Control

NAME_____

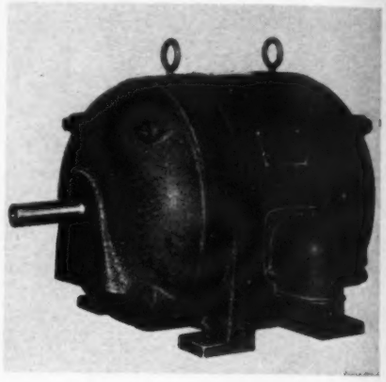
ADDRESS_____

MOTOR CONTROLS • BRAKES • LIMIT STOPS • MAGNETS

filter, and circulate the oil to the machines. Some models provide alarms to indicate stoppage in supply of oil, to show the amount of oil in the tank, to make known when the system pressure has reached the low point. S. F. Bowser & Co., Inc., Fort Wayne, Ind.

Spatter-Proof, Semi-Enclosed Motor

General-purpose squirrel-cage induction motors, 1-75 hp., are built in a range of sizes for general and special applications. For general-purpose drives such as pumps



and machine tools, Type RS with normal torque and normal starting current is recommended; for normal-torque, low-starting-current applications—Type RSL; for such installations as air compressors and plunger pumps where high-torque, low-starting-current motors are required—Type RSH. Special motors also. Lima Electric Motor Co., Division of Lima Armature Works, Inc., 438 North Main St., Lima, Ohio.

Clamp

Designed to hold work together, the clamp features quick-acting toggle movement. It has two holding rods, and when released by toggle action, the entire lower half swings clear of the work. This enables the operator to get around obstructions in fixtures and to take in and clamp such pieces as angle iron or T-shaped iron. One model has two threaded rods for easy adjustment. The other has two smooth rods which are set-screw adjusted. The latter is especially suited to arc welding. The clamp is made of malleable iron, the rods of steel, the toggle handles of case-hardened steel. It is said not to distort up to a pressure of 1,000 pounds. Detroit Stamping Co., 3461 West Fort St., Detroit.

Fluorescent Lamp Ballasts

Said to provide performance characteristics that exactly coincide with requirements of fluorescent lamps they are designed to power, and to furnish quick starting and humless operation. Available in designs for single-lamp applications of 15, 20, 30, 40, 65, and 100 watts; also in double-lamp applications of the same lamp sizes. The Acme Electric & Mfg. Co., Cuba, N. Y.

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del "CHTF"—Light-duty fork truck designed expressly for light unit load operation. apacities 1000 and 2000 lbs. Has full telescopic fork lift 120"—Collapsed height 83". ceptionally compact for box car operation d narrow platform or aisle maneuvering.

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This means you must have the highest efficiency in the movement and storage of materials to cope with your increased production demands.

That's where "AUTOMATIC" is prepared to perform its part in this program by furnishing you with proven equipment to give your system top-performance and low-cost materials storage and transportation. Industrial research over the past few years will give you the benefit now, without experimenting, of the latest and most satisfactory types.

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DIV. OF THE YALE & TOWNE MFG. CO.
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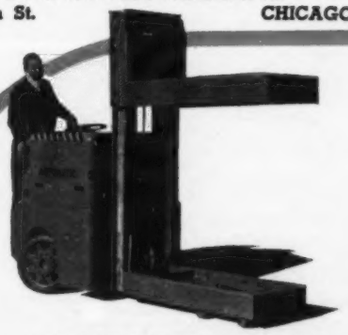
Model "LN-3"—For speedy transportation and placing of 6000-lb. skid loads. Has standard platform 55" long, 27" wide, 10¾" high with 6" lift—Spur gear, drive and lift units—Rotor-Brush control system.

Model "TLN-3"—For 6000-lb. skidloads tiering plus transportation. Has standard platform 55" long, 27" wide, 10¾" high, 60" lift.



Model "TLO-5"—For heavy duty transportation plus tiering of 10,000-lb. capacity skid loads. Has standard platform 60" long, 26¼" wide, 11" high with 60" lift. The very latest in electrical control—construction styling and performance efficiency.

Model "EN-2"—Exceptionally speedy and efficient for ramp operation. Equipped with pneumatic tires for outdoor service. Platform deck 100" long, 51" wide, 29" high. Has heavy-duty spur gear drive—Hand wheel steer and Rotor-Brush control.

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DIV. OF THE YALE & TOWNE MFG. CO.
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Gentlemen: Please send details on models referred to above.

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"We have been enthusiastic users of 'Oildag' for over ten years", says Besler Systems, "and we find it the only material which will prevent bolts, nuts and flanges from seizing under high temperature and pressure conditions in our boilers.

"For this purpose, each man in our assembling department is provided with (a small can of) Concentrated 'Oildag' and a small solder brush with which he paints the threads on the bolt before screwing on the nut. Under this practice bolts have reached temperatures of at least 900° F., not only for long periods of time, but for many repetitions, and on dismantling were found to have been free." . . . . another example of the excellent service performed by "dag" colloidal graphite under severe conditions.

Many other high temperature lubrication successes are reported thoughout industry with "dag" colloidal graphite dispersed in various liquids, even volatile solvents. Write for "The Treatment of Screw Threads" and literature on this subject. Your oil supplier can furnish you a "dag" colloidal graphited product upon request.

dag COLLOIDAL PRODUCTS

ACHESON COLLOIDS CORPORATION
PORT HURON MICH.

Here are a few of the many uses of colloidal graphite in industry—check any with which you may be having lubrication difficulties.

"DAG" COLLOIDAL GRAPHITE FOR:

CONVEYORS..... ■
FORGING DIES..... ■
COMPRESSORS..... ■
GLASS MOLD..... ■
ASSEMBLY AND RUN-IN.... ■
SCREW THREADS..... ■
STEAM CYLINDER..... ■
CASTING..... ■
CONDUCTIVE COATINGS.... ■
IMPREGNATION..... ■

Tear off this coupon and attach to your letterhead—it will bring a working sample for the uses you specify.

ACHESON COLLOIDS CORPORATION • Port Huron, Michigan

How Many Automatics Should a Man Run?

(*Continued from page 85*)

6-Machine Basis

$(0.062)^6$	$=$	$0.0000 - 6$
$(0.062)^5 \times 0.938 \times 6$	$=$	$0.0000 - 5$
$(0.062)^4 \times (0.938)^2 \times 15$	$=$	$0.0002 - 4$
$(0.062)^3 \times (0.938)^3 \times 20$	$=$	$0.0039 - 3$
$(0.062)^2 \times (0.938)^4 \times 15$	$=$	$0.0447 - 2$
$0.062 \times (0.938)^5 \times 6$	$=$	$0.2701 - 1$
$(0.938)^6$	$=$	$0.6811 - 0$
		1.0000

7-Machine Basis

$(0.062)^7$	$=$	$0.0000 - 7$
$(0.062)^6 \times 0.938 \times 7$	$=$	$0.0000 - 6$
$(0.062)^5 \times (0.938)^2 \times 21$	$=$	$0.0000 - 5$
$(0.062)^4 \times (0.938)^3 \times 35$	$=$	$0.0004 - 4$
$(0.062)^3 \times (0.938)^4 \times 35$	$=$	$0.0065 - 3$
$(0.062)^2 \times (0.938)^5 \times 21$	$=$	$0.0586 - 2$
$0.062 \times (0.938)^6 \times 7$	$=$	$0.2956 - 1$
$(0.938)^7$	$=$	$0.6389 - 0$
		1.0000

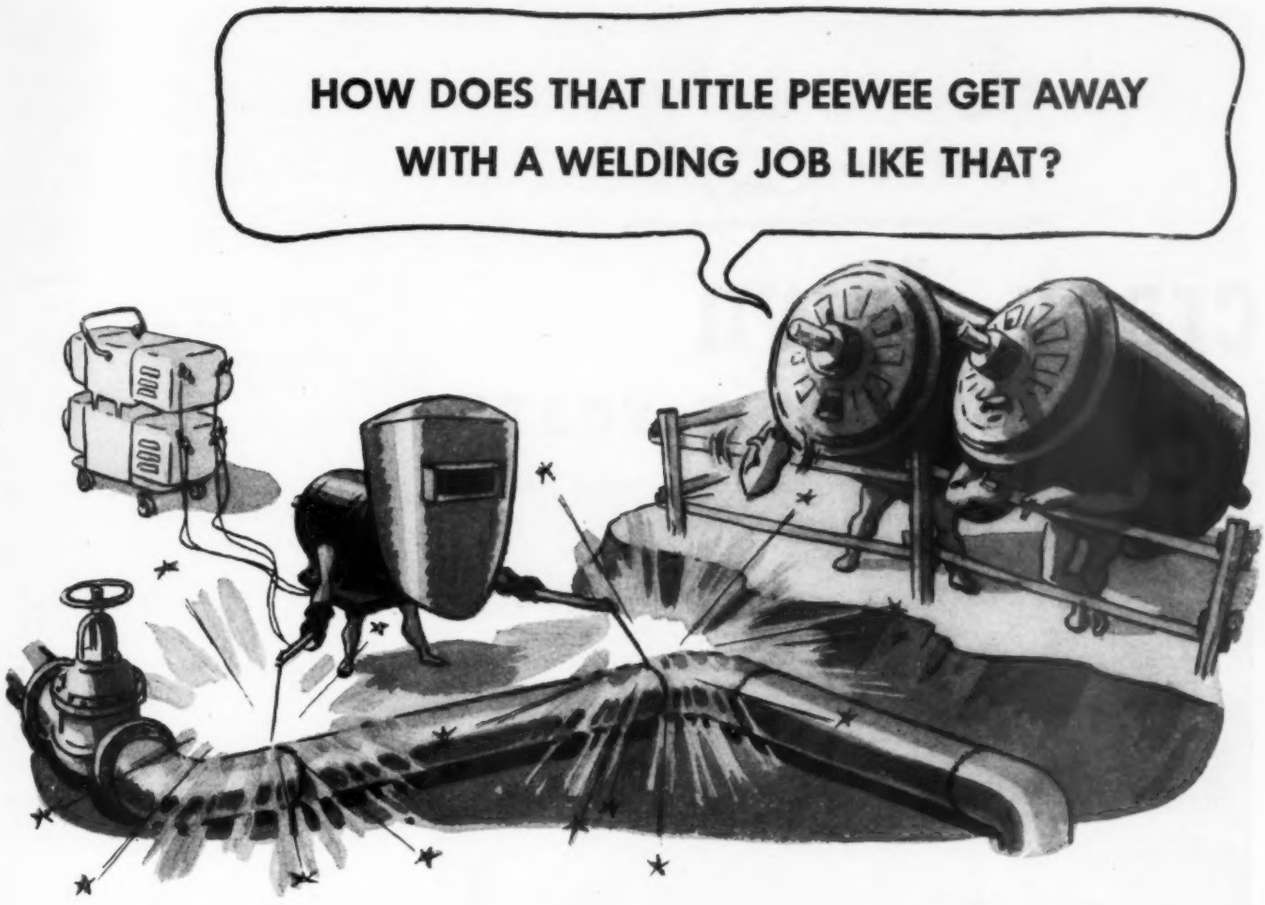
8-Machine Basis

$(0.062)^8$	$=$	$0.0000 - 8$
$(0.062)^7 \times 0.938 \times 8$	$=$	$0.0000 - 7$
$(0.062)^6 \times (0.938)^2 \times 28$	$=$	$0.0000 - 6$
$(0.062)^5 \times (0.938)^3 \times 56$	$=$	$0.0000 - 5$
$(0.062)^4 \times (0.938)^4 \times 70$	$=$	$0.0000 - 4$
$(0.062)^3 \times (0.938)^5 \times 56$	$=$	$0.0097 - 3$
$(0.062)^2 \times (0.938)^6 \times 28$	$=$	$0.0733 - 2$
$0.062 \times (0.938)^7 \times 8$	$=$	$0.3170 - 1$
$(0.938)^8$	$=$	$0.5992 - 0$
		1.0000

On an 8-machine basis the operation will be occupied as follows during machine-down time.

Number of Machines Down			*Percent of Time*
1		=	31.70
2	0.0733×2	=	14.66
3	0.0097×3	=	2.91
4	0.0008×4	=	0.32
5		=	0.00
6		=	0.00
7		=	0.00
8		=	0.00
	Total	=	49.59

This keeps the operator occupied about 50 percent of the time which seems fair, thus allowing the other 50 percent for watching his work, getting containers, etc., and resting. Therefore, it seems that 8 machines is the ideal basis provided the cost shows up favorably. For cost purposes let us consider the average r.p.m. of 122. In arriving at efficiencies for the various machine bases, it must be borne in mind that when one machine only is down there is no loss in efficiency in a multiple basis over a unit basis. However, when two machines are down, one machine is waiting while the operator is occupied with the other. When three machines are down, one machine waits while the first is being attended, and the third has twice the wait while the



How Fiberglas* insulated generators solved a welding problem—and the moral for you

A MANUFACTURER of arc welders had developed a new model.

It was small, inexpensive, and so designed that two men could weld from the same unit at the same time. This meant two leads and of course a correspondingly larger output of current from the generator. But here was the hitch.

An ordinary cotton-insulated generator, large enough to deliver the output wanted, made the unit cost too high. A smaller generator brought the cost in line, but burned out when both leads were in use.

The problem was to find a smaller generator with a Class B insulation which was inexpensive to install . . . which would resist the high temperature developed at 3600 r.p.m.—the speed at which the generator ran to deliver the welding current needed.

The arc-welder manufacturer found such an insulation in Fiberglas. Used it on the magnet wires of the smaller generator. And of the scores in use today, *not one has failed*. Some of them work on 24-hour schedules.

This case history spotlights two mighty important superiorities of Fiberglas.

Here is superiority #1

Several important manufacturers are now making *smaller-size* Fiberglas-insulated motors and generators. And these still have a *substantially larger safety factor* than ordinary units insulated with Class A materials, even though they operate at approved higher temperatures. Their cost is a little more in some cases—often no more.

Or, by changing from Class A to Fiberglas insulation, you can get the *maximum safety factor* in *standard-size* motors and generators.

Now for superiority #2

If you have tough jobs around your plant, you get a highly superior "tough job" electrical insulation in Fiberglas. For Fiberglas resists heat, chemical vapors, moisture, and most types of process dust *better than ordinary electrical insulations*.

So, don't forget! Downtime costs money. Holds up defense production. And with machinery operating more hours at higher speeds, you can't afford to take the chance on breakdowns.

You need an increased safety factor! Specify Fiberglas Electrical Insulation. *Owens-Corning Fiberglas Corporation, Toledo, Ohio.* In Canada: *Fiberglas Canada Ltd., Oshawa, Ontario.*

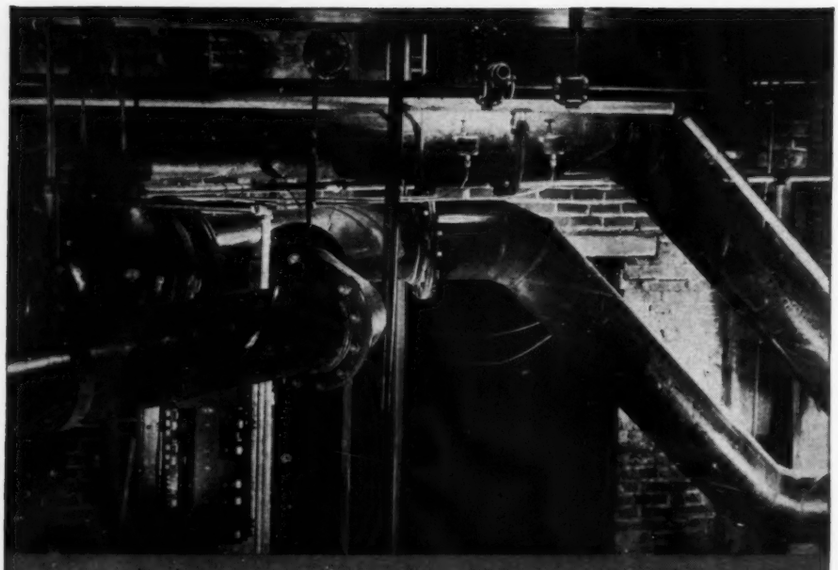
OWENS-CORNING

FIBERGLAS*

*T. M. Reg. U. S. Pat. Off.

SPECIFY FIBERGLAS ELECTRICAL INSULATION

crack down
ON PIPING COSTS!



ARMCO'S method of prefabricating pipe simplified the job and saved at least seven sets of flanges on this short section of line. Only a few supports were needed.

You can make pipe dollars go farther and insure trouble-free service by using ARMCO "Spiral Welded" for new lines or replacements.

Savings often run as high as 25 to 30% because every foot of ARMCO Spiral Welded Pipe is tailor-made to fit the job. Standard or special fittings come welded to straight pipe runs and you eliminate at least one pair of flanges at every bend. Even the most complicated layouts go in quickly.

Maintenance is sure to be low when you use ARMCO Spiral Welded Pipe. Fewer flanges naturally mean fewer joints, less chance for leaks. Then too ARMCO Pipe has no threads to weaken the metal and invite corrosion.

ARMCO Spiral Welded Pipe is available in diameters from 6 to 36 inches with wall thicknesses from 7/64 to 1/2-inch. Mail us your rough plans for a convincing demonstration of its many advantages. We'll submit an accurate cost estimate and a sketch of our proposed design. The American Rolling Mill Company, Pipe Sales Division, 701 Curtis Street, Middletown, Ohio.

ARMCO

SPIRAL WELDED PIPE

first and second are being attended. It becomes a case of arithmetical progression, with one wait when two machines are down; 1+2, or three waits when three machines are down; 1+2+3, or six waits when four machines are down; ten waits when five are down, and so on. On an 8-machine basis, therefore, the analysis would be:

	Percent
One machine down (normal)	6.2
Machines down while operator is occupied	10.7
Tool and machine delays	5.8
Personal delays	5.0
Total delays	27.7
Efficiency	72.3

The earnings and costs would be as shown in Table II.

In the last column of this table we see that the cost goes down very slowly from a 6 basis on, and it should be made optional whether the basis adopted be 6, 7 or 8.

The reason for the use of probabilities rather than an actual study first, is because there is always reasonable doubt about how many machines to expect an operator to look after. So the delay study can be made on any number of machines and then by probabilities the correct basis determined and established. Then, if the operator has his doubts, a production study on the suggested basis can be made, and unless abnormal conditions of material are encountered there should be no difficulty in satisfying the operator. He should be given to understand that, if he tends more machines than before, he will earn more money per hour than under the previous basis.

Where stocking-up times vary for different machines, the use of probabilities becomes more complicated. Take, for example, high-speed screw machines. How many machines should a boy look after who is just re-stocking machines? Again, how many in case the operator re-stocks, grinds, and sets up his own tools and jobs? Each job would have to have a certain basis. Therefore the operator might be running 8 machines, based as follows:

Machine	*Basis*	*Hourly Rate $0.75*
A	8	$0.094
B	5	0.15
C	6	0.125
D	8	0.094
E	9	0.083
F	6	0.125
G	5	0.15
H	7	0.107
	Total	$0.928

In this case, the operator's theoretical earnings come to $0.928 per hour, instead of his task earnings of $0.75. However, he has too many machines to look after, and as a consequence the

Painting's just a matter of dollars and sense

. . . when you can use the best paint at a lower "on-the-wall" cost, it's plain horse sense to do just that. Check up and you'll find that means . . .

BARRELED SUNLIGHT

• For more than 40 years, Barreled Sunlight has been recognized by plant maintenance men as the quality leader in the industrial white-paint field—as the white that means lower "on-the-wall" costs.

But . . . did you know that today Barreled Sunlight costs you *no more per gallon* than ordinary good white paint?

No wonder plant operators the country over report greater savings than ever with Barreled Sunlight whites! And because Barreled Sunlight offers you not one but THREE money-saving whites—each the finest available in its price range—you can get just the white you need to meet your plant conditions *and your pocketbook!*

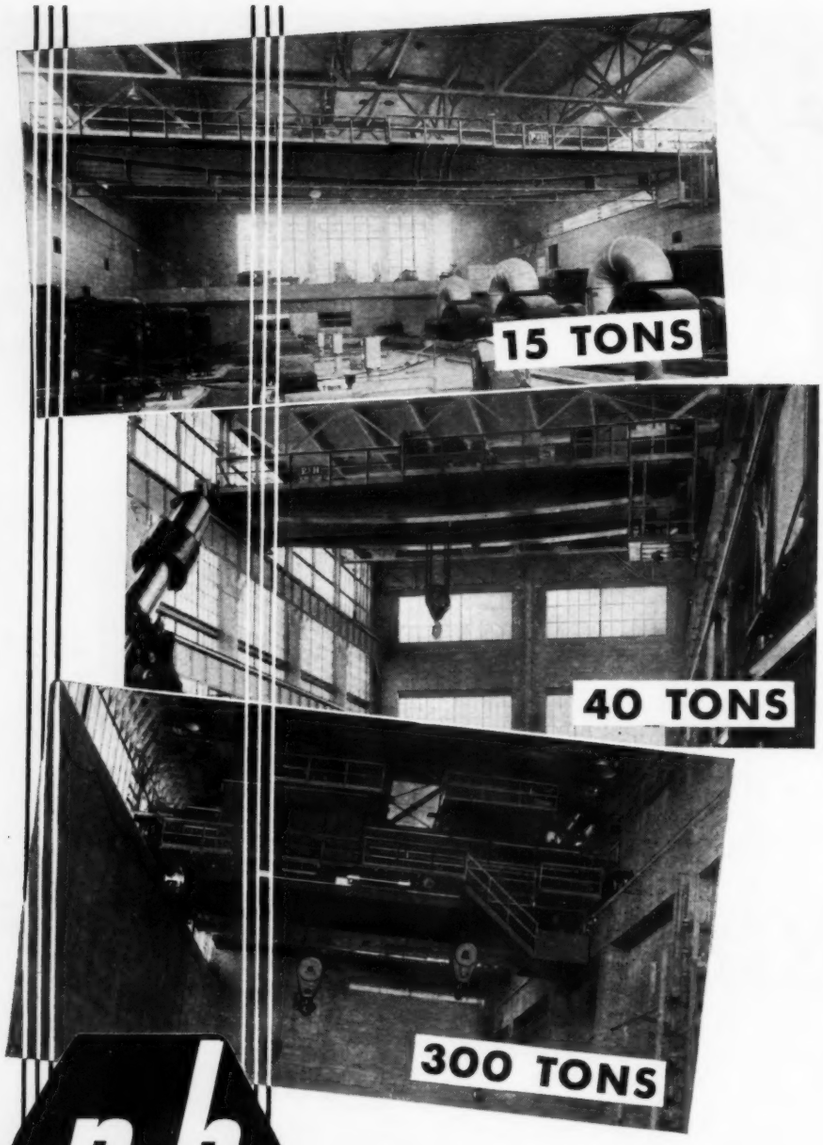
This year, buy your paint this way. Talk to your Barreled Sunlight Representative. Let him inspect your plant. He'll show you which of the three Barreled Sunlight whites is best suited to your purpose. You'll find his recommendations will help you get a finer, whiter, longer lasting paint job for less money!

Send for free booklet—"The Right Paint for Your Plant." U. S. Gutta Percha Paint Co., 2-C Dudley Street, Providence, R. I.

SECRET OF BARRELED SUNLIGHT'S 40 years of leadership is never-ending research. Working with the exclusive Rice Process—*which* (because it defies chemical analysis) *no chemist can copy*—Barreled Sunlight chemists have made Barreled Sunlight whiter and whiter, given it far higher white-retention, greater flowing, hiding and spreading powers. And they've made all these advantages possible at the same price you'd pay for ordinary white paint.

BARRELED SUNLIGHT

SPECIALISTS IN WHITE PAINT FOR INDUSTRY FOR 40 YEARS



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machine efficiencies will be lower than expectations, and consequently his hourly earnings will be close to $0.75. This is a bad condition, during high activity periods, because high-priced machines lie idle too much of the time, and it tends to raise costs. If we leave out machine *B* or *G*, the basis becomes right and earnings become approximately $0.75 per hour.

We have other presses on a 2-machine basis that probabilities show should be on a 4-machine basis. Accordingly the piece rates will be established on a 4-machine basis. Now there are times when an operator must run a combination of presses, some based on 8 machines, and others on 4. How many presses should the operator attend in such instances? The task earnings for both bases is $0.80. Therefore the task earnings per machine is $0.10 on the 8 basis and $0.20 on the 4 basis. Now, any combination of machines that will add up to $0.80 is the correct basis where more than one type of press is being run. For instance, 2 of the 8-basis and 3 of the 4-basis types, or 4 of the 8-basis and 2 of the 4-basis machines will total $0.80 per hour.

To get down to brass tacks, no one can say that 3, 4, or 5 machines is the basis we should use in all cases in a certain shop. Each type of machine must of necessity vary from some other types; where there is such variation in time, different bases should be established. The operator will work just as hard on one basis as another—that is, he will be occupied a definite percentage of the total time on all bases calculated by probabilities.

Where the operator does his own adjusting, the basis must, of course, be lower. Let's revert to the first example and use an operating adjuster in place of an operator and an adjuster. In this case the times will be 11.1 percent for being occupied and 88.9 percent running. Let's start arbitrarily with a 4-machine basis and then work on from there if necessary.

4-Machine Basis

$(0.111)^4$	$= 0.0002 - 4$
$(0.111)^3 \times 0.889 \times 4$	$= 0.0049 - 3$
$(0.111)^2 \times (0.889)^2 \times 6$	$= 0.0584 - 2$
$0.111 \times (0.889)^3 \times 4$	$= 0.3119 - 1$
$(0.889)^4$	$= 0.6246 - 0$
	1.0000

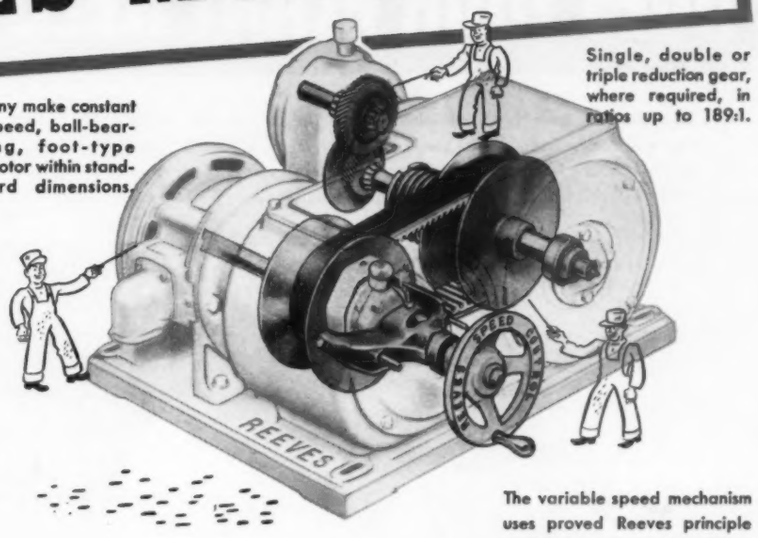
On this basis, the operating adjuster is occupied as follows:

	31.19%	− 1 machine down
$0.0584 \times 2 =$	11.68	− 2 machines down
$0.0049 \times 3 =$	1.47	− 3 machines down
$0.0002 \times 4 =$	0.08	− 4 machines down
Total	44.42%	(occupied)

This is under 50 percent, which is a fair measuring stick. Therefore let's

the REEVES MOTODRIVE

COMBINES MOTOR, VARIABLE SPEED MECHANISM AND GEAR REDUCER IN A SINGLE COMPACT UNIT

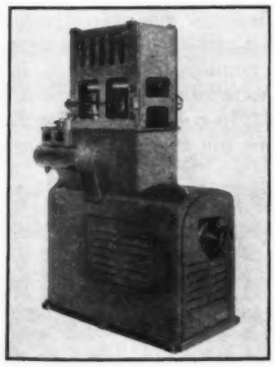


Any make constant speed, ball-bearing, foot-type motor within standard dimensions.

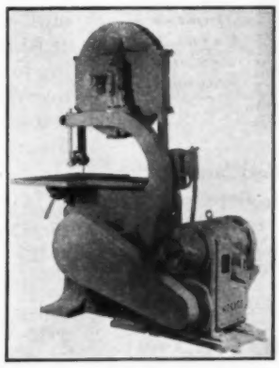
Single, double or triple reduction gear, where required, in ratios up to 189:1.

The variable speed mechanism uses proved Reeves principle for infinite speed adjustability.

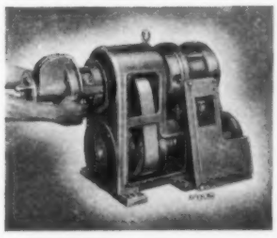
● This complete, modern variable speed power plant is designed for use on production machines where space is limited or where direct connection to machine is necessary or desirable. Provides infinite speed variation within predetermined limits. Output speeds from 1.35 to 3480 r.p.m. may be obtained. Utilizes proved REEVES principle of V-belt driving between two pairs of cone-faced discs, adjustable to form an infinite number of driving and driven diameters. The Motodrive is not restricted to any one make of motor. Built in horizontal and vertical designs in capacities from 1/4 to 10 h.p. and in speed ratios from 2:1 through 6:1. Available with or without speed reducer. Many different assemblies as to positions of motor, output shaft, handwheel and speed reducer give extreme flexibility in mounting. Send for Catalog-Manual G-397, which gives full details on the Motodrive and describes the complete line of REEVES Variable Speed Control and its use on all types of production machines in over 18,000 industrial plants.



INSTALLATION WITHIN FRAME of Welding Rod Hopper Feeding machine. Permits operator to vary feeding speeds instantly and accurately according to size of rods entering extrusion press.



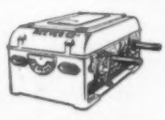
INSTALLATION ON METAL BAND SAW. Merely by turning handwheel, operator secures any speed needed for best results in sawing different sizes and types of metal, without stopping his machine.



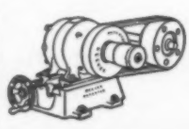
EASY TO CHANGE BELT. *Above, left:* by removing four cap screws, shifting assembly is removed as complete unit. *Right:* V-belt is quickly and easily removed through opening in case.

The Other 2 Basic Units in REEVES Line

VARIABLE SPEED TRANSMISSION. Provides infinite speed adjustability over wide range. Accurate and positive at all speeds. Modern, compact open and enclosed designs, vertical and horizontal. Fifteen sizes—fractional to 87 h.p. Speed variations from 2:1 to 16:1 inclusive.



VARI-SPEED MOTOR PULLEY. Simplified development of Transmission. Mounts on standard shaft of any constant speed motor. Forms direct drive to machine. Sliding motor base is moved forward or back for speed changes. Ten sizes—fractional to 15 h.p.; 3:1 speed range.

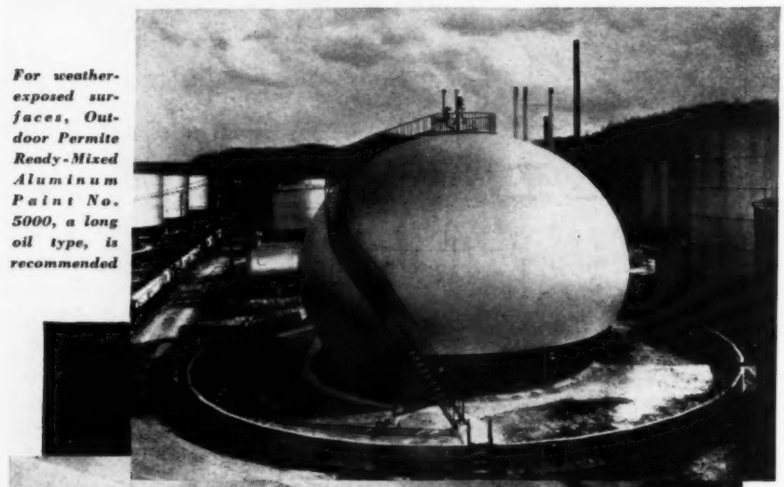


REEVES PULLEY COMPANY, *Dept. F,* **Columbus, Indiana**

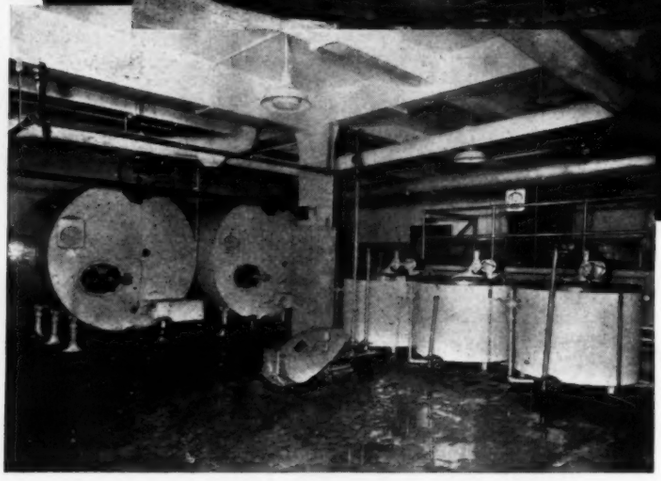
REEVES ACCURATE POSITIVE SPEED CONTROL

Which of these Aluminum Paints DOES YOUR PLANT NEED?

Because no one type of aluminum paint can be equally effective for outdoor, indoor, heated surfaces, wet walls, product finishing, etc., Permite has developed for industrial paint users a complete line of Ready-Mixed Aluminum Paints—a specific type for every purpose.



For weather-exposed surfaces, Outdoor Permite Ready-Mixed Aluminum Paint No. 5000, a long oil type, is recommended



For wet or moist surfaces, Permite Ready-Mixed Aluminum Paint No. 1600 is recommended!

Where a brilliant, chrome-like finish is required to reflect more light and increase safety and efficiency in the plant, Permite Aluminum Paint No. 1000, a short oil type with high reflective qualities, is recommended. And remember, like all Permite Aluminum Paints, it is completely ready-mixed!

Write for 56-page paint manual

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PERMITE *Ready-Mixed* ALUMINUM PAINTS

see how a 5-machine basis will work out.

5-Machine Basis

$(0.111)^5$	= 0.0000	– 5
$(0.111)^4 \times 0.889 \times 5$	= 0.0007	– 4
$(0.111)^3 \times (0.889)^2 \times 10$	= 0.0108	– 3
$(0.111)^2 \times (0.889)^3 \times 10$	= 0.0866	– 2
$0.111 \times (0.889)^4 \times 5$	= 0.3467	– 1
$(0.889)^5$	= 0.5552	– 0
	1.0000	

On this basis the operating adjuster is occupied as follows:

	34.67%	– 1 machine down
0.0866×2 =	17.32	– 2 machines down
0.0108×3 =	3.24	– 3 machines down
0.0007×4 =	0.28	– 4 machines down
Total	55.51%	

This is more than 50 percent so I would choose 4 machines as the basis, with an efficiency of 76.5 percent.

The question that naturally follows is, which is the better set-up—one operator and one adjuster for 8 machines or one operating adjuster for 4 machines? In the former case the hourly output or task is 41,800 and the labor cost per hour is \$0.80+\$0.80 or \$1.60, giving a cost of \$0.038 per M. In the latter case the task would be 22,100 and labor cost per hour \$1, giving a labor cost of \$0.045 per M. So the 8-machine basis for operator and adjuster gives a 15 percent lower cost and almost equal production.

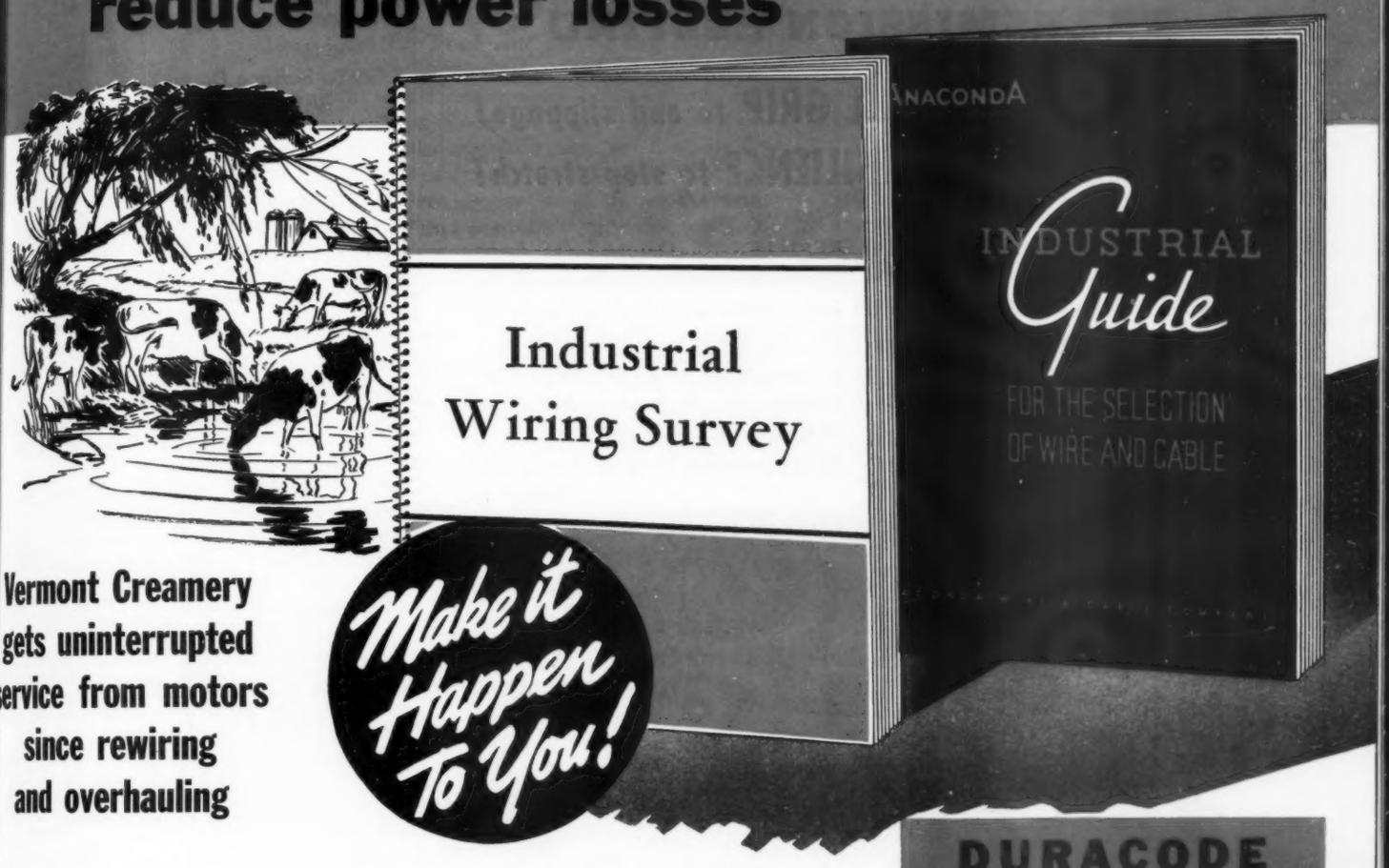
Now we come to a group of machines on which all different components are being run and the re-stocking time for the operator varies greatly. In such a case, it is best to rate each machine individually and let the operator run as many as he thinks he can look after. Bear in mind that, if he attends too many, his efficiency will fall so that his earnings will be lower than on the correct number. Suppose we fix the earnings per hour for the correct number at \$0.75 and rate each machine according to the number he would run, if all machines were similar to the one being considered. In a group of 10 machines, 5 were being run at the time as follows:

Machine Number	*Percent Re-stocking*	*Correct Machine Basis*	*Task Earnings per Machine*
29323	8.8	5	\$0.15
29331	6.7	6	0.125
30022	4.7	10	0.075
30021	16.2	3	0.25
29334	5.4	9	0.083

In the above case, if an operator ran the 5 machines, his task earnings would be \$0.683, so that he could run still another machine like No. 30022 or No. 29334. Of course, we don't want to split hairs, but the theoretical task earnings for an average man should be about \$0.75, with an exceptional man going higher by running more, and *vice versa* with a man below average ability. Now,

SAVES $100 A MONTH

...when wiring survey shows how to reduce power losses



Vermont Creamery gets uninterrupted service from motors since rewiring and overhauling

ARE you sure that your plant electrical system is adequate . . . that it is serving you economically? Remember, power leaks aren't visible. They can't be spotted as easily as a leaky pipe. And because they can't, authorities estimate that nine out of every ten plants in the country are actually losing money simply because they are *unaware* of these power losses.

Make sure that you are getting your money's worth from your electric power investment. A wiring survey such as the Vermont Creamery used costs nothing to make. It will prove to you that your system is adequate or that it needs re-wiring.

• • •

ASK YOUR CONTRACTOR TO HELP YOU

Your regular electrical contractor is equipped to make this survey for you. He knows how to use Anaconda's new Wiring Survey and Guide. Get in touch with him immediately. 40368

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IT'S ENTIRELY **New**... IT'S DEFINITELY **Better**...

OCTOPUS

TRANSMISSION BELTING

New—POWERFUL GRIP *to end slippage!*

New—GREAT RESILIENCE *to stop stretch!*

OCTOPUS Transmission Belting has been eight years in the making. Research . . . development . . . tests . . . more research . . . more development . . . more tests . . . over and over again . . . have finally resulted in this *one belt* that *combines* POWERFUL GRIP and GREAT RESILIENCE. Octopus (1) *keeps machinery running* at top speed, (2) *saves time and money* on take-ups, (3) *provides long belt life* under hard service. With this new and better belting you have new and true assurance of . . .

MORE PRODUCTION at LESS COST

350% LONGER SERVICE
on this woodworking machine
5" diameter cutter head pulley runs at 5000 r.p.m. Belt also runs over idler.
Read what user writes—
"Previously we never got more than six weeks' service out of any other belt. The original Octopus Belt (installed August, 1940) is still running and in good condition (written January 24, 1941).
"Your Octopus Belt holds our sticker up to speed, gives no troublesome slippage or stretch and in general is giving us the best service we ever had on this machine."
Frederick Kaiser, Pres.
Better-Bilt Door Co., Inc.
Jenkintown, Pa.

Get the facts and you'll get Octopus—write

MANHEIM MANUFACTURING & BELTING CO., MANHEIM, PA.

the individual machine rates having been set, they need not be changed again no matter how they are grouped, unless the r.p.m. or the length of stock is changed.

It must be remembered that if the r.p.m. of a machine are changed, the down-time will change in proportion. For example if r.p.m. are increased from 85 to 100 and down-time was 6.2 percent, it would now be 7.3 percent. Also, if length of stock be increased, down-time would decrease inversely.

To Reduce Down-Time

The next important measure is to keep the indirect employees interested in keeping down-time to an irreducible minimum, even stepping in and restocking when more than one machine is down simultaneously. To do this, the following incentive is practical. Take the direct labor and the indirect labor over a period of weeks. Set up as a budget the ratio of indirect to direct over this period. For any reduction in this ratio, share the savings equally between adjusters and company. In one case we have 5 adjusters and 5 operators, and the ratio or budget is 1.25. Now, by reducing this ratio, either by one less adjuster or greater machine efficiencies, the adjusters and operators are on an effective incentive plan which must show beneficial results to all concerned.

Safety Is Safest Under Medical Supervision

(Continued from page 81)

There is another side to an effective safety and health program that receives little consideration—the general morale of all employees. Men and women like to work in pleasant surroundings where they can be free from worry about being injured. Such environment attracts the higher type of workman when the employment department sends out the call for help. This improved morale is bound to result in higher efficiency of all employees, and reduce the labor turnover.

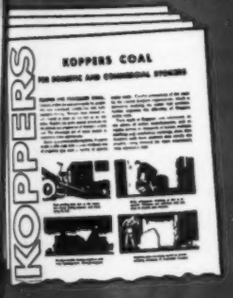
Since our new department has been set up the decrease in accidents has been conspicuous. Improvement in the accident reports are to be expected, of course, since campaigns are continually being waged, but the sharp drop shown in the table is largely the result of closer cooperation under a single directing agency. In the table, frequency is the number of accidents per million hours worked, and it is significant that service jobs, where condi-

FROM THE
PPERS LIBRARY OF
NICAL INFORMATION

TO BUILD STEEP ROOFS

TO AVOID TROUBLE ON
SHAFT CONNECTIONS

TO PROTECT NEW AND
BUILDINGS FROM TERMITES



WHAT COALS TO USE
FOR STOKERS

KOPPERS IS FIRST AGAIN!

Underwriters Laboratories Awards Class A Rating to Koppers Steep Roofs

Koppers Steep Built-up Roofs constructed of Steep Coal Tar Pitch and Tarred Rag Felts with slag surfaces have been awarded the Class A Rating by the Underwriters Laboratories, Inc.

Koppers Flat Roofs of Coal Tar Pitch and Tarred Rag Felts have had the Class A rating for fire resistance for more than 20 years. Koppers Steep Roofs provide for steep slopes the same long life, the same resistance to water, weather, and fire that have made coal tar pitch and tarred felt the outstanding materials for flat built-up roofs.

Four and five ply Tarred Rag Felt roofs with slag surfaces embedded in Steep Pitch, applied in accordance with the specifications of the Koppers Company, now take a Class A rating on both combustible and non-combustible roof decks.

Koppers Steep Roofs have been constructed in many sections of the country over a considerable period of years. These roofs have been inspected by the Underwriters' Laboratories for their performance under actual service conditions and the completed roofing has also been subjected to all the laboratory tests for resistance to fire and to spread of fire.

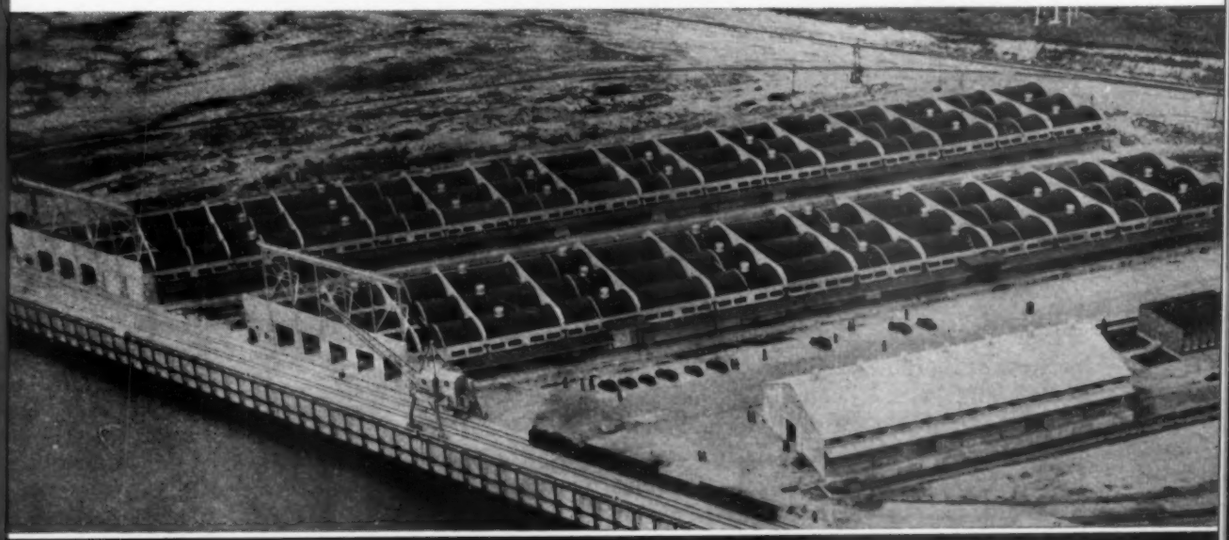
Koppers Steep Roofs are firmly and mechanically anchored in place. They can be bonded for 10, 15 or 20 years. On buildings where there are both flat and steep roof surfaces, the entire area can now be bonded, when Koppers Built-up Roofing is specified.

See specifications for Koppers Steep Roofs in Sweet's, or send for a copy of the Koppers Roofing Book.

Specify that all roofing materials must carry Underwriters' Labels.

KOPPERS COMPANY
Tar and Chemical Division
KOPPERS BUILDING · PITTSBURGH, PA.

262,000 sq. ft. of Koppers Steep Roofing was used on the Deepwater Terminal, Richmond, Va.



use KOPPERS *products*

KOPPERS COMPANY, 1123 Koppers Building, Pittsburgh, Pa.
Please send me the following folders:

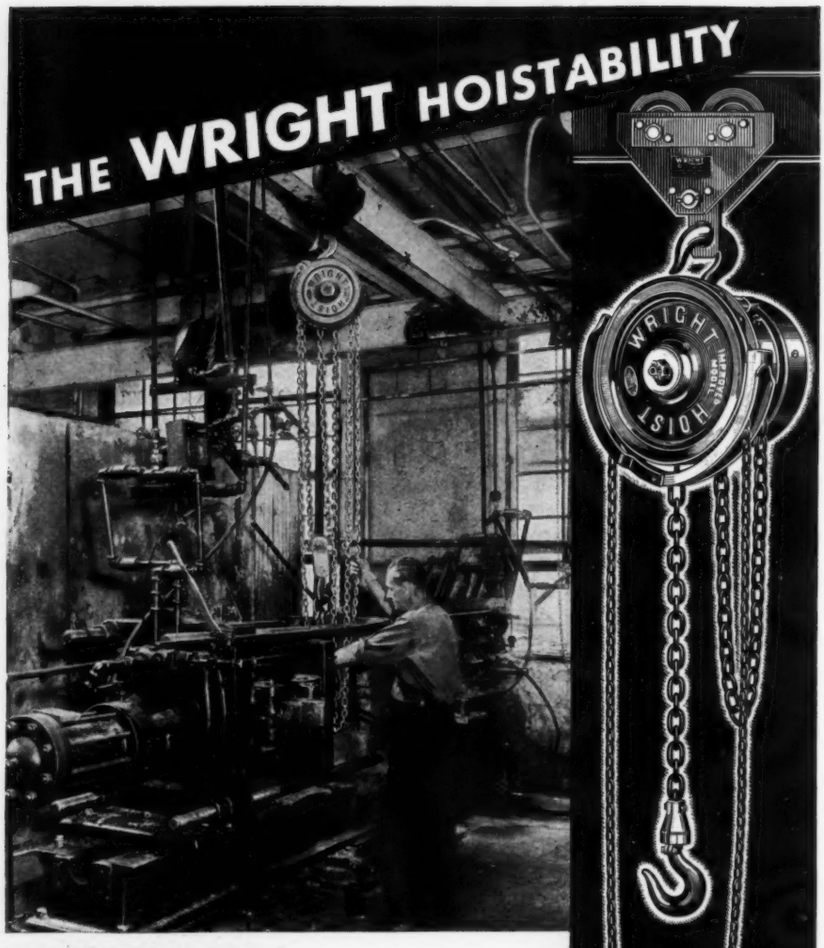
- ☐ "Steep Roofs of Coal Tar Pitch"
- ☐ "Fast's Self-aligning Couplings"
- ☐ "Prevention of Termite Damage"
- ☐ "Coals for Stokers"
- ☐ "Coals for Industrial Use"
- ☐ "Coal Tar Disinfectants"
- ☐ "Membrane Waterproofing"
- ☐ "Dampproofing"
- ☐ "Tar-base Paints"
- ☐ "Piston Rings for Compressors"
- ☐ "Tar Acids"
- ☐ "Coal Tar Solvents"
- ☐ "D-H-S Bronze"

Your Name.....

Title.....

Company.....

Address.....



WRIGHT *Improved High Speed* **HOISTS**

HAVE "HOISTABILITY" which means vertical transportation with *speed, economy* and *safety*.

Every WRIGHT *Improved High Speed* HOIST is *fast*, smooth and positive in action—because of Wright precision load wheel and driving spindle bearings. It is *economical*, being highly resistant to corrosion because of its full zinc coating.

It is *safe* with a load chain that stays in the pocket, regardless of operating position—because of the Wright safety guard.

Furthermore, the load chain has a safety factor of 7 to 1, and is made of a special process steel which permits it to elongate (under overload) 3″ to the foot before breaking. Likewise the bottom hook will slowly open so that anyone can see the danger when loaded beyond the elastic limit of the chain.

WRIGHT TROLLEYS are as dependable as Wright Hoists—made to give long, faultless service. . . . Write for the WRIGHT CATALOG describing modern hoisting equipment in capacities from ¼ to 50 tons.

WRIGHT MANUFACTURING DIVISION
YORK • PENNSYLVANIA

AMERICAN CHAIN & CABLE COMPANY, Inc.
In Business for Your Safety

tions very often cannot be controlled, are more hazardous.

In the works division, that is, factory and shop, where campaigns are intensive and conditions are controllable, the accidents have dropped greatly. A frequency decrease in 1938 of about 44 percent over 1937 was one of the best records in the history of the company. The combined frequency rating of both works and service in 1938 showed a decrease of 34 percent over 1937. It must be remembered that an accident is recorded here only when an employee is unable to report to work the next day. The day of the accident and the day he reports to work are not counted in arriving at the number of days lost.

The 1939 figures were just as encouraging. The frequency decrease over 1938 in the works division was 25 percent, 43 percent in service, and 32 percent in the combined ratings.

Such data really show better than all argument the value of smooth coordination between medical and safety men in a plant of any size.

Training by Correspondence

(Continued from page 88)

where apprentices of 35 companies located in 5 cities and in 2 states are receiving training. The actual supervision is provided by 2 state departments of education and 5 city boards.

Training programs may further be broken down:

1. An organized program where management agrees to keep the subject of training before employees at all times, but does not sponsor supervised study room periods.

2. An organized training program where study rooms are provided so that employees can meet at designated periods to study under supervision. This is by far the most effective type of industrial training. The study room periods are often held on company property under company supervision.

3. An organized training program where employees attend study room periods, these rooms being situated outside of company property, and under the supervision of some outside organization, such as the school authorities.

Group training may be broken down into three categories:

1. Apprentice training.
2. Adult or journeyman training.
3. Foremanship training.

An average ICS text contains 55

IT'S HERE!

the new and sensational "LOAD KING" HYDRAULIC LIFT TRUCK

CAPACITIES:
3,500, 5,000, 6,000,
8,000 LBS.

-YALE-

The truck that gives SAFETY—EASY LIFT—EASY STEER—EASY ROLL—GREATER STABILITY—MANEUVERABILITY—LONG LIFE

BACKED BY YEARS of research and grueling field tests, Yale now offers to industry, the perfectly-balanced Hydraulic Lift Hand Truck.

Every part is pre-planned for outstanding heavy-duty service. Load platform and lifting saddle are reinforced heavy plate and bar steel, arc-welded into a unit structure with broad-faced bearing surface lifting links. The Yale Hydraulic lifting unit is specifically designed as an integral part of the truck.

Operator lift-effort is reduced to pump action on handle or treadle. Load weight completely borne by lifting unit. Length of pumping stroke is optional with the operator.

Steering effort minimized by a Timken thrust bearing on steering column. Truck rolls easily—all wheels ball bearing equipped and pressure lubricated.

You can't "corner" the "LOAD KING". It lifts and steers at any point within a 200-degree arc. Handle is free at all times. Never a "Flying Handle". Hydraulic lifting unit holds load in elevated position. Balance spring returns handle to upright position, eliminates tripping, relieves operator of carrying handle weight.

★ **YALE HYDRAULIC LIFTING UNIT** is self-contained, totally enclosed, fully guarded and protected from outside shock and damage. Automotive type piston and piston rings guarantee maximum oil pressure at all times. Hardened and ground poppet valves, operating on hardened and ground valve seats, eliminate necessity for inefficient needle valves and insure trouble-free operation. Large-diameter, solid steel lift ram operates in a cylinder equipped with Chevron seals encased in bronze bushings. Large ram reduces necessary oil pressure 50%. Oversized (5 pint—5 yr. supply) oil reservoir insures continuous operation.

• SEE THE ADVANTAGES OF THE "LOAD KING"

• MAIL COUPON FOR FREE TRIAL IN YOUR PLANT

THE YALE & TOWNE MFG. CO.
4530 Tacony Street, Philadelphia, Pa.

( ) Please send literature on the Hydraulic Load King.
( ) We are interested in your FREE TRIAL offer.

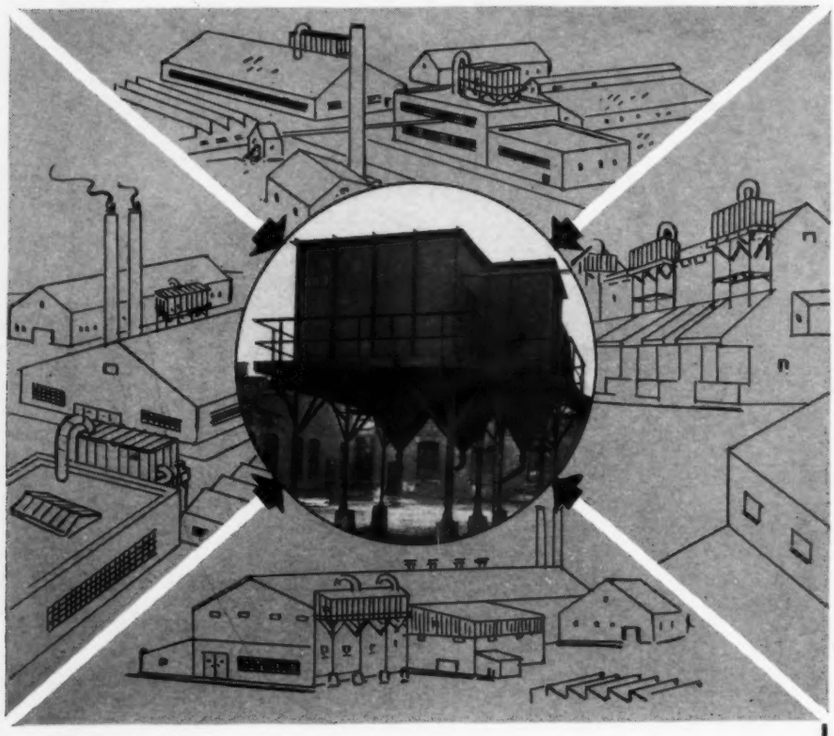
Name_____

Company_____

Street_____

City_____ State_____

● SLY DUST FILTERS COLLECT OVER 100 DIFFERENT KINDS OF DUST IN 56 INDUSTRIES.



SLY DUST FILTERS Sold in one year remove annually 150,000 tons of dust

THE *new* Sly Dust Filters installed in *one* year have a capacity of about three and one half million cu. ft. of dust laden air per minute. On a basis of 5 grains of dust per cu. ft., and in an operating year of 250 8-hour days, these filters annually collect 300,000,000 lbs., or 150,000 tons of dust! It would take 150 freight trains of 50 20-ton carloads to haul this enormous quantity.

Translated into terms of industrial efficiency, these Sly Dust Filters have eliminated tremendous losses of product, dusty plants, discomfort to thousands of workers, and wear and tear on machinery. And the thousands of Sly units sold in other years are giving equally outstanding service.

Yet Sly Dust Control brings industry all these benefits at low cost. Sly Dust Filters increase plant efficiency in so many ways that they soon repay their cost. They require less space and power. *Ask for Bulletin 98, and tell us about your problem so that we can write you fully.*

THE W. W. SLY MFG. CO.

Branches in Principal Cities

4755 TRAIN AVENUE CLEVELAND, OHIO

SLY

INDUSTRIAL DUST CONTROL

pages and 20 examination questions. The text matter constituting a single lesson is equivalent, on the average, to 10 ordinary high school assignments.

Twenty-six schools comprise the ICS educational department, each under the supervision of a director, principal, assistant principal, and a chief instructor. The dean of the faculty, assisted by three associate deans, acts as administrator of this department's functions, and those of the ICS editorial staff.

More than 200 full-time instructors maintain the service.

An educational service division, which consists of a director, and more than 100 employees, is occupied continuously in keeping scholarship records, reporting students' progress to their employers, writing letters of encouragement, and rendering other services.

Correspondence courses are also offered by 45 universities and colleges which are members of the National University Extension Association with headquarters at Bloomington, Ind. (Dr. W. S. Bittner, Secretary).

Courses are given in some 900 subjects, including the following that may be of special interest to plants with defense orders:

Aeronautics
Air Conditioning
Blacksmithing
Blueprint Reading
Chemistry
Diesel Engineering
Drawing, Mechanical
Economics: Labor
Electricity
Engineering, Elect.
Engineering, Mech.
Engineering, Power Plant
Engineering, Radio
Foremanship
Gas and Oil Engines
Human Relations
Industrial Engineering
Job Analysis
Machine Design
Management, Factory
Management, Personnel
Paper Manufacturing
Physics
Radio
Refrigeration
Steam Boilers
Strength of Materials
Telephony
Television
Textiles
Vocational Guidance
X-rays

In addition to offering regular correspondence courses, at least one of these 45 institutions, Rutgers University, New Brunswick, N. J., has a special program of extension training now in progress for employees and executives in essential industries of national defense and other basic industries. It includes courses in time study, motion economy theory and techniques, foremanship, and labor relations for executives.

To assist industry in the defense emergency, the Rutgers Extension Division made these four key courses available to all plants, regardless of size, in New Jersey industrial centers. The program was designed to meet four specific needs of an expanding industry, affected directly or indirectly by the pressure for

No additional equipment NEEDED

for this modernization program

Actual photograph of a Gulf engineer discussing the benefits of improved lubrication with the Plant Supervisor on a Periodic Consultation Service call.

GULF PERIODIC CONSULTATION SERVICE *keeps Plant Lubrication Practice up to date*

HERE'S a practical plan for modernizing your lubrication—to help your machinery meet today's increasing production requirements.

You need not wait to install additional equipment in order to get the benefits of GULF PERIODIC CONSULTATION SERVICE. Just take this first step: Call in a Gulf engineer and ask him to look over your plant equipment, then make recommendations which will insure better operation through improved lubrication. Finally, see that his recommendations are carried out to the letter. Scores of plants are reaping the benefits which accompany the use of Gulf's higher quality lubricants—better quality and quantity of production, fewer operating interruptions, and lower costs for maintenance and repairs.

The wide distribution of Gulf quality oils and greases through 1100 warehouses in 30 states from Maine to New Mexico assures you of prompt service. Write or phone your nearest Gulf office today.

SEND FOR THIS BOOKLET

GULF INDUSTRIAL LUBRICATION

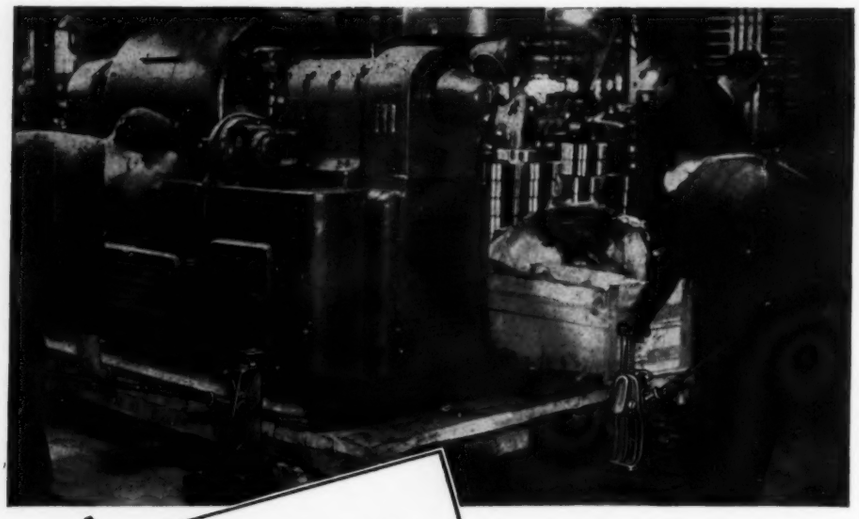
Gulf Oil Corporation-Gulf Refining Company
3800 Gulf Building, Pittsburgh, Pa. FM&M

Please send me my copy—no charge—of the booklet "GULF PERIODIC CONSULTATION SERVICE."

Name.....

Company.....

Address.....



"ALL OUT" *demands* Highest Shop Efficiency THROUGHOUT!

MODERN "SPECIALIZED" JACKS are your Efficiency-Aides!

A FEW OF THE MORE THAN 300 DUFF-NORTON TYPES and SIZES

Ball Bearing Screw Jack for extra heavy duty. Sizes 15 to 100 tons.

This "Jack of All Trades" combines straight lifting, with chain, hook, and foot-lifting.

The handy Ball Bearing Jack Screws are made in 38 sizes. 5 to 30 tons capacity.

Countless important jobs are done more quickly, more efficiently, more safely when your men have the right DUFF-NORTON JACK to help them. To make sure your jacks are up to par, have them checked over NOW by a Duff-Norton jack expert—the obsolete and worn items replaced by new, modern jacks.

This same man may be able to suggest ways of speeding up your lifting, lowering, pushing or pulling jobs by using special or standard Duff-Norton jacks.

Ask your Distributor about Duff-Norton Jacks.

THE DUFF-NORTON MFG. CO.
PITTSBURGH, PA.
Canadian Plant: Coaticook, Quebec
"THE HOUSE THAT JACKS BUILT"

speed and economy in national defense production.

1. A clear perspective of labor relations problems.

2. Adaquate sources for increases and replacements in supervision.

3. Continuous study of operations to reduce costs through improved methods.

4. Intelligent development and application of time standards to work and wages.

Each of these four courses is being conducted in four or more New Jersey industrial centers—the survey course in foremanship, for example, being given in Trenton, Camden, Newark, Jersey City, Hackensack, Paterson-Passaic area, and New Brunswick.

Will NLRB Say "Discrimination!"?

(*Continued from page 73*)

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important tests that the board applies in determining whether discrimination exists or not, and in so doing it will provide the employer with a knowledge of what actions will be likely to bring a charge of discrimination against him. A knowledge of such tests will tend to indicate certain personnel practices that are desirable to place in effect in advance of labor difficulties. Much time and money may be saved by improving morale with the adoption of up-to-date personnel practices, and by avoiding the time and expense of hearings before the board.

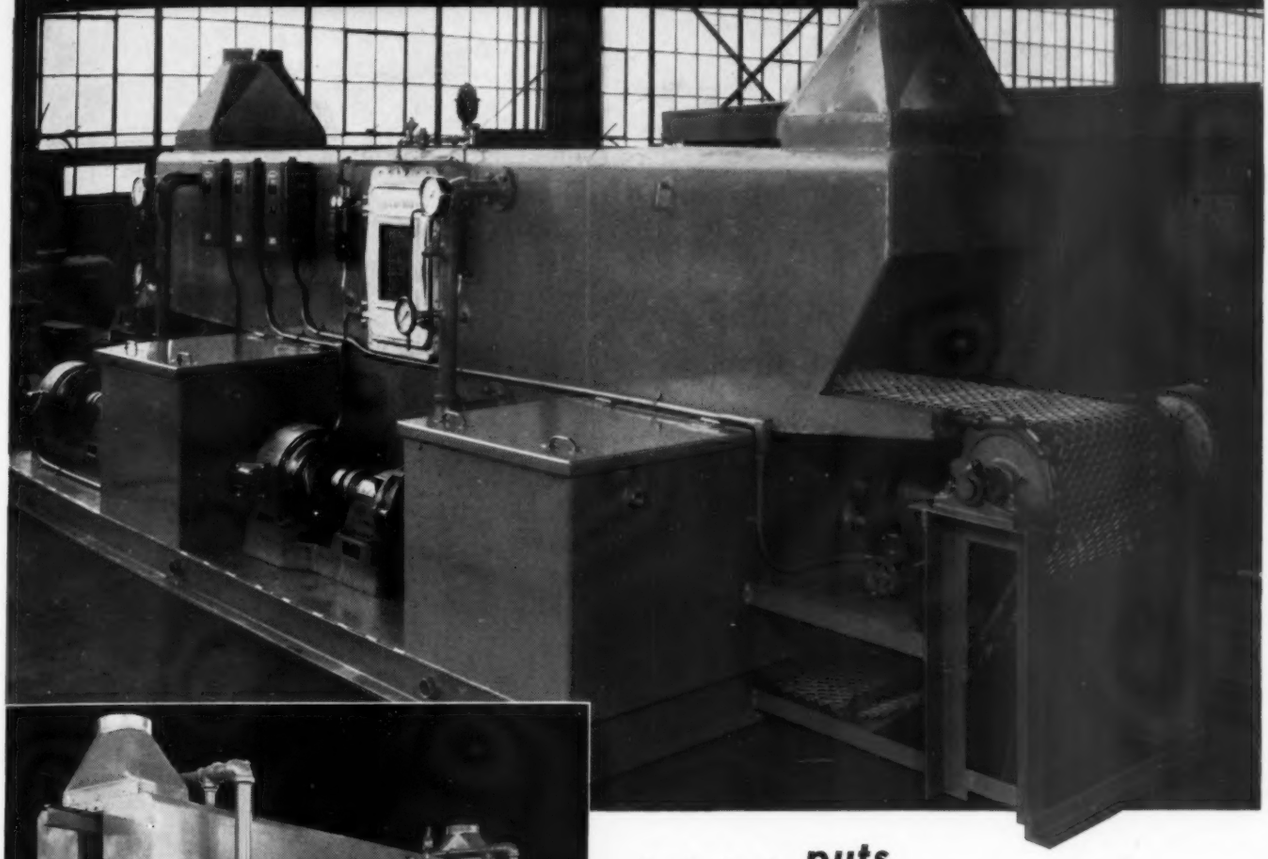
In dealing with a charge of discrimination brought against an employer either at the time of hiring, discharge, lay-off, or reinstatement, the board seeks to establish an answer to the following general questions:

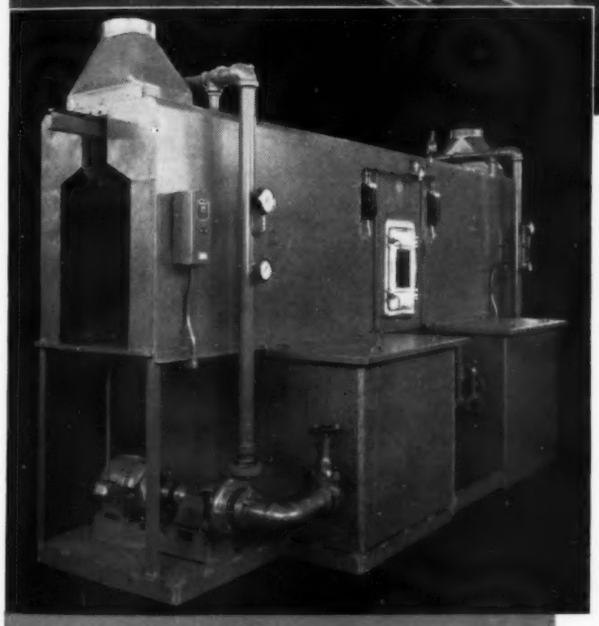
1. Was the employer motivated wholly or in part by an anti-union attitude? The board through cross-examination of witnesses and interpretation of evidence decides what have been the employer's motives in each situation.

2. Do the employer's actions indicate discrimination against a worker because of his union affiliation or activities? The board often finds that, although the employer's actions are in themselves proper, nevertheless the motive that lies behind such actions is discriminatory.

The employer, in answering a charge of discrimination brought against him by an employee or his representative, must be able to prove that he acted soundly upon grounds other than those of opposition to unionism. It is the

Mahon FINISHING Eauipment





METAL CLEANING MACHINES
are an important part of almost every Finishing System. Large view shows the Mahon Apron Type and, directly above, the Mono-rail Type, two methods used for conveying parts through the washing compartment. Each of these machines was entirely constructed by Mahon.

. . . . puts FINISHING on a PAYING BASIS

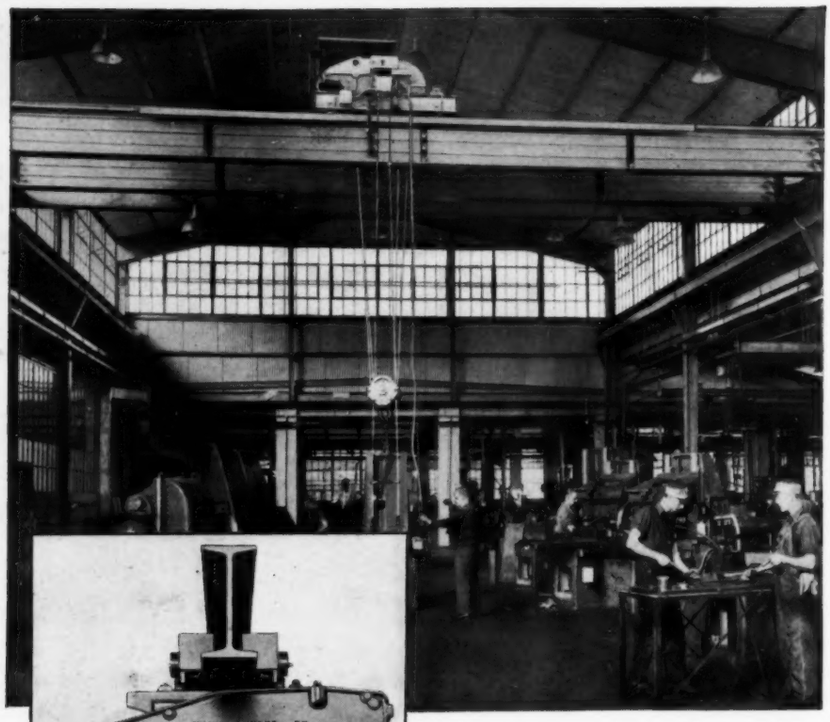
Your first consideration in the selection of any Finishing Equipment is the *operating efficiency* of the equipment in continuous day-after-day production. Operating efficiency depends largely upon the practical experience and the knowledge of modern production methods of the organization that makes it. Weigh this factor carefully when considering the purchase of such equipment—which so directly affects profitable production in your plant. It is the reason why more and more manufacturers are turning to Mahon for properly engineered, thoroughly coordinated, dependable Complete Finishing Systems—or any single Finishing Unit. Your inquiries will have our most careful attention.

THE R. C. MAHON COMPANY
DETROIT—CHICAGO

Designers and Manufacturers of Complete Finishing Systems, Metal Cleaning Machines, Rust-Proofing Machines, Hydro-Filter Spray Booths, Ovens of All Types, Filtered Air Supply Units, Hydro-Foam Dust Collectors and Many Other Units of Special Production Equipment.

MAHON

"Take it up" with R & M



↑ 10-ton capacity, 45-foot span, 3-motor R & M crane with two-speed, pendant, push-button controlled R & M hoist handling heavy castings in a leading machine tool assembly plant.

← New Type I-Beam R & M electric hoist of all-steel construction, with built-in steel trolley and safety lug, providing a line of steel from track to hook. Electrical equipment enclosed.

MORE material to move . . . costly jams slowing up production . . . headroom space at a premium . . . the *right* hoist and crane needed to fit the job efficiently, economically.

It's a wise plant engineer who, faced with conditions like these, suggests "taking it up" with R & M.

In case after case, industries planning expansion, shops needing a step-up of present facilities, have found the most *profitable* answer in service-tested R & M hoists and cranes.

R & M's 2,000 models provide a standard hoist or crane to meet practically any type of material-handling problem. If none of these fits *your* set-up, a special job that does is tailored to order for you.

A brief session with an R & M expert may mean a saving of thousands of dollars. Call your nearest Robbins & Myers office now. Or write the factory direct today explaining your problem.

ROBBINS & MYERS, Inc.

HOIST & CRANE DIVISION • SPRINGFIELD, OHIO

MOTORS • FANS • MOYNO PUMPS • FOUNDED 1878

policy of the board to make a "realistic examination of all the surrounding circumstances" in order to get at the relevant facts which might prove or disprove the employer's purported reason for the action complained of. The board commonly applies one or more of the customary tests that follow; but it should be emphasized that each case usually involves a combination of several tests:

1. *Attitude toward unions.* What have been the employer's actions, statements, or general attitude over a period of time in relation to unions and their members? Has he expressed them himself or through his supervisory force in such a way as to interfere with, threaten, or coerce his employees?

2. *Knowledge of union affiliation.* Did employer have knowledge of employee's union membership prior to the action complained of, and was the purpose and effect of such action to discourage union membership? How has the action been timed in relation to the employee's union activities?

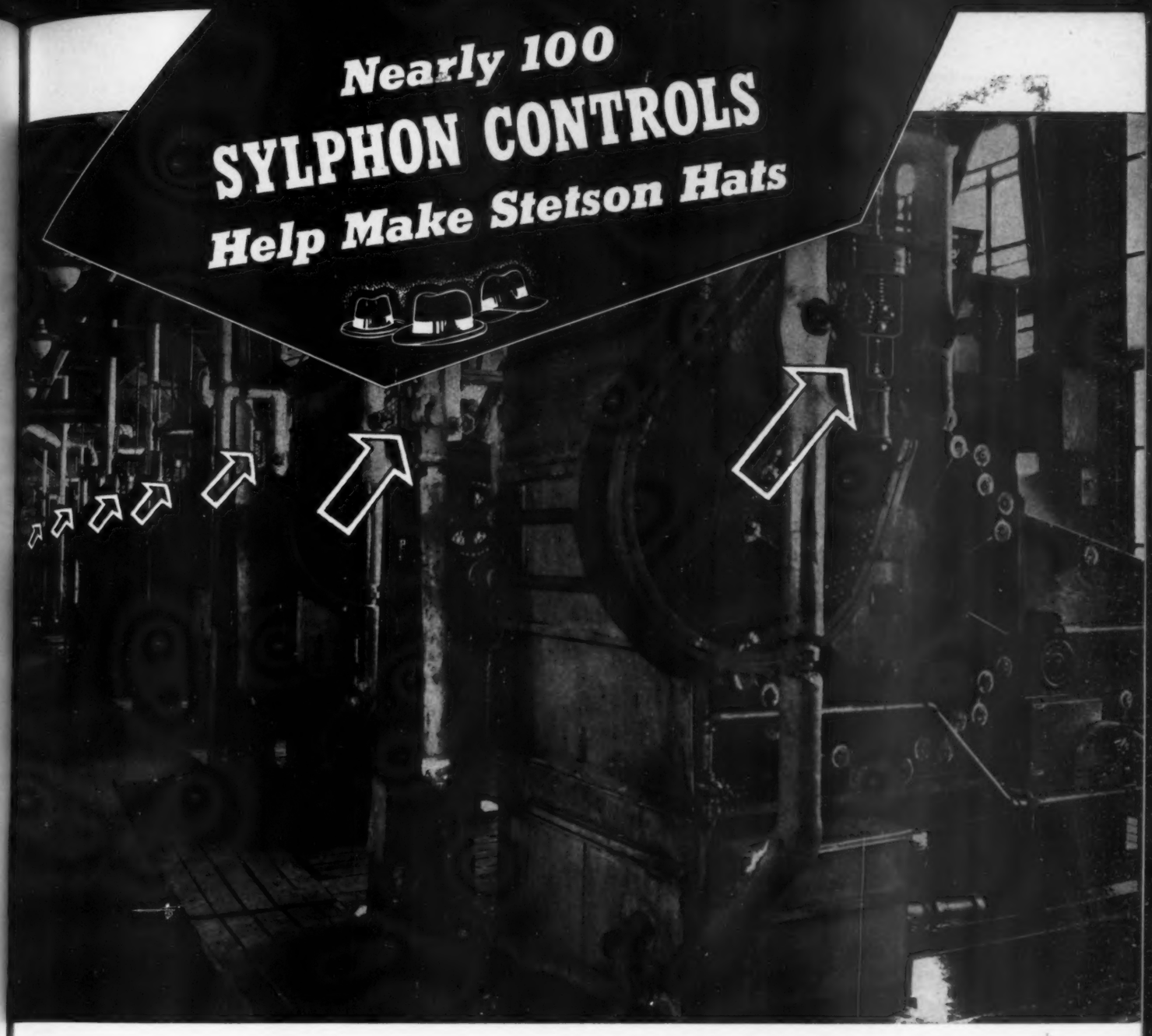
3. *Employer's customary action.* What action has the employer taken in similar situations before? Have non-union employees been subjected to similar treatment in the past and on this occasion? Is employer conforming to past customs and practices?

4. *Adherence to plant rules.* Are plant rules clearly stated, posted, or explained, and well understood by all? Have they been strictly adhered to in similar situations in the past with union as well as non-union employees? Are the rules being used as a pretext to cover up an anti-union action?

5. *Performance on the job.* Are all the requirements of the job, production and quality standards, safety methods, responsibilities, and conduct fully understood by the employee in advance? Was the employee less efficient over a period of time than other non-union men retained? Have instructions been clearly given without prejudice, are they well understood, reasonable in the situation, and customary?

6. *Warning.* Has the employee been forewarned of the consequences of serious misconduct? Has adequate warning been given in advance in cases of lesser importance stating that repetition will mean dismissal? Is present situation serious enough to justify the extreme penalty of discharge, or would a warning be more reasonable?

7. *Proof of statements.* Is substantial long-term evidence available, accumulated in written form over a period of time? Has careful investigation preceded to justify action taken and to place responsibility definitely on the



The John B. Stetson Company, world-famous hat makers, purchased their first Sylphon Temperature Regulators 20 years ago. Since then this company reordered many times to apply Sylphon Controls to Genest shrinking machines (illustrated), Apron Settlers, Hot Water Generators, Oil Heaters and other equipment where accurate, dependable, automatic regulation of temperature is essential.

There must be good reason why the list of Sylphon Control users reads like a "Who's Who" of American Industry. Do you know what outstanding improvements in production efficiency and economy Modern Sylphon Regulation may be able to offer your plant—how small the cost and how simple the installation? Ask the local Fulton Sylphon Representative to survey your problem, or write for Bulletin EF-20.

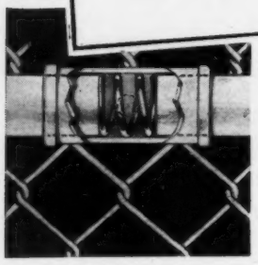
FULTON *Sylphon* TRADE MARK FOR TEMPERATURE CONTROL

THE FULTON SYLPHON CO.

KNOXVILLE, TENNESSEE

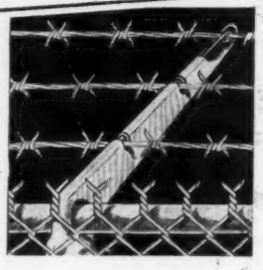
Representatives in All Principal Cities in U. S. A. and in Montreal, Canada and London, England

Why most plant owners choose Cyclone Fence



CYCLONE'S sturdy spring coupling compensates for expansion and contraction of top rails due to extreme temperature changes. It prevents bending or breaking of rails – reduces upkeep costs.

BARBED WIRE is locked into notches in the Cyclone extension arm by a key inserted at the end. This allows adjustment of barbed wire to compensate for expansion and contraction. Only Cyclone offers this valuable feature.



IT will pay you to know why Cyclone sells more property protection fence than any other manufacturer. For the important Cyclone features that make it the leader in sales also make it the best buy for you.

Right now, more plant owners than ever are concerned with adequately protecting their property – to guard valuable blueprints, expensive machinery, important dies and tools. We therefore offer the following information on important features of Cyclone Fence that give better protection at lower cost:

WIRE MESH—heavy copper steel. Galvanized by Cyclone's "12M" process that gives it extra years of life. Galvanizing is done *after* weaving so that cracks will not form and allow rust to start.

POSTS—H-column steel—strongest possible construction for its weight—set in concrete bases that frost can't weaken.

TOP RAILS—tubular steel. Spring couplings compensate for expansion and contraction—prevent broken and bent rails.

GATES – Strong and well-braced. Cyclone's exclusive ball and socket hinge permits free swinging, prevents dragging.

EXTENSION ARMS—Several types are available. All use the principle illustrated above to allow adjustment after expansion and contraction of wires.

ERECTION SERVICE—Cyclone factory-trained erection crews are on our own payroll and we are responsible for their work.

QUICK DELIVERY—Cyclone service is fast. We can meet almost any emergency delivery requirement. Write for recommendation and estimate.

CYCLONE FENCE COMPANY, *Waukegan, Ill.*
(DIVISION OF AMERICAN STEEL & WIRE COMPANY)
Branches in Principal Cities
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32-Page Book on Fence

Send for our free 32-page book that tells all about fence. Crammed full of facts, specifications and illustrations. Shows 14 types—for home, school, playground, and business. Whether you need a few feet of fence or 10 miles of it, you need this valuable book. Buy no fence until you see what Cyclone has to offer.

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Please mail me, without obligation, a copy of "Your Fence—How to Choose It—How to Use It."

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individual? Has such person had an opportunity to state his side?

8. *Soundness of reasons.* Are bases for action taken sound, and based on measurable factors that are fair and generally accepted in the industry? Have violations been flagrant or repeated? Is the company partly responsible for the conditions leading up to the final action taken?

9. *Adequacy of records.* Have records of previous complaints and performances been kept systematically for all? Were they started only when union activity within the plant became serious? Are they accurate?

10. *Statement of reasons.* Can the employer back up the chief reason for discharge without resorting to contradictory reasons? Are there witnesses to back up the testimony given by both sides, and is testimony reasonable?

In providing answers to the above questions, the employer may test whether his actions may be subject to a charge of discrimination or not. All that the board requires of the employer is that his actions be fair, reasonable, and unprejudiced in each situation after consideration of all factors; and above all, that his actions be not motivated by an anti-union attitude which is directed at undermining or obstructing the union and its members in the exercise of their legal rights.

As stated by the board, "all employers have wide latitude in discharging employees; the only requirement of the NLRA is that employees must not be discharged on account of union activity or union affiliations." There are many cases where the board has backed up the employer's action, once it has become satisfied that no discriminatory motive was present. In the fiscal year 1938-1939, regional directors of the board secured the withdrawal of 1,269 unfair labor practice cases after a preliminary investigation revealed that the charges made against the employer did not warrant formal proceedings before the board.

It is apparent from the foregoing that the employer should have a definite, reasonable basis for action when it becomes necessary, and that such action should be supported by demonstrable policies, principles, and facts strictly adhered to. Several general personnel procedures suggest themselves as worthy of consideration in some form by all concerns:

1. *Plant rules* carefully arrived at, comprehensive, clearly stated, posted conspicuously, well understood, and strictly adhered to by all in all situations regardless of who is involved,

AIR-MAZE FILTER-SILENCERS

Oil Bath Filter Silencer — *Multimaze Filter Silencer* — *Unimaze Filter Silencer*

Air-Maze engineers have developed a highly efficient acoustical chamber as an *integral part* of the Oil Bath, Multimaze and Unimaze type filters. Not to be confused with a silencing device merely "added-on" to filter, Air-Maze Filter Silencer Units provide exceptionally efficient protection against dust (99% *plus*) and, at the same time, eliminate all objectionable intake noises. Write for bulletin FSP-89.

Reduce the toll of dust-laden air! Provide your engines, blowers and air-compressors with the unsurpassed protection of

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Give your equipment adequate defense against the abrasive action of dust and grit. Install Air-Maze air filters and *prevent* excessive wear, needless overhauls and under-par efficiency. Air-Maze air filters assure *clean* air with negligible restriction of air flow. They are simple to install, easily cleaned and *will not clog* under normal conditions. Available in a complete range of sizes—oil bath and viscous types—cylindrical or panel design—and the Filter-Silencer units described at left. Write today for complete catalog.

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5120 Harvard Avenue **Cleveland, Ohio**

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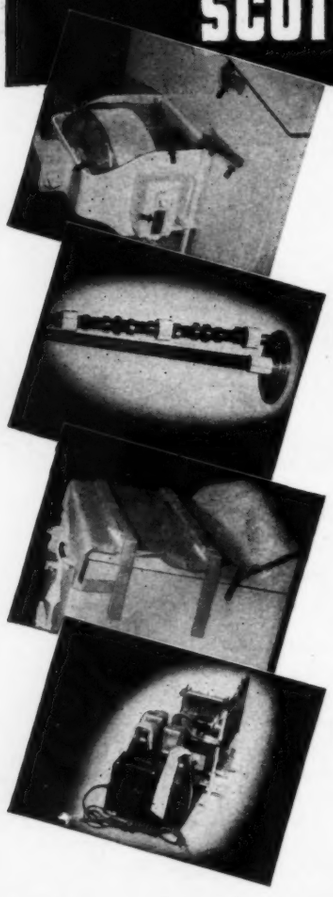
DEPENDABLE AIR FILTERS FOR EVERY APPLICATION

READ ALL ABOUT MANY USES FOR
SCOTCH *Adhesive* TAPES



For MASKING wood, metal or enameled surfaces when painting two-tones, stripes, borders or small areas. The use of Scotch Adhesive Tape means clean, sharp color separation without built-up edges.

For PROTECTING machined surfaces. In the use illustrated, single wraps of Scotch Adhesive Tape are easily applied over bearing surfaces for safe protection against abrasions until installation.

For HOLDING packing materials, doors, drawers and loose parts firmly in place to assure safe transportation. Scotch Adhesive Tapes have the necessary strength and adhesive tack to "stay on the job" until removed.

For SEALING detachable or loose units and for sealing openings and vents against infiltration of dirt or other foreign matter. Tapes are available in widths from ¼" to 26" for these purposes.

Scotch Adhesive Tapes are pressure sensitive and easy to apply—no moistening or heating required. When the work is finished, tape is quickly removed and does not require cleanup. Write for full information and for your free sample roll today.

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provide a sound basis for action and a definite guide to supervisors and employees alike. Company labor policies similarly expressed have equal advantage to all parties.

2. *Records* are invaluable. The employee's service card should provide a thorough, cumulative record of all important facts indicating his desirability as an employee. Job information, medical ratings, accident record, tardiness and absence record, and job performance records are important. In addition some sort of personnel development record should be available on which may be recorded cumulative supervisory ratings, suggestions accepted, educational and other developments favorable to the employee, as well as a continuous record of complaints, warnings, etc., which may be causes for eventual discharge. The primary purpose of development records should be the constructive advancement of each employee to his maximum effectiveness.

3. *Warning* should be given employee when violation of rules, sub-standard production, or other detrimental data are recorded against his name. By explaining the reason and getting the employee's story, the supervisor may promote cooperation to prevent further difficulty. A straightforward system of this kind should gain the confidence of all involved.

4. *Discharge* should be approved by the superintendent before it becomes final. The supervisor should lay the employee off for the cause given, telling the employee to state his case to the employment department within two days. After considering both sides, the superintendent should consider the motive involved and O.K. the discharge if he sees fit.

The responsibility for avoiding a charge of discrimination rests with the men in top management. It is for them to establish the company labor policies and determine what attitude shall be taken with regard to unions. Whatever their personal prejudices, their actions must be guided by law and the decisions of the Labor Board. With a knowledge of the tests that the board applies in seeking to prove a charge of discrimination, it should be top management's job to bring personnel policies up to date, and inform supervisors of the proper action that should be taken where discrimination might be charged. In the last analysis, however, whether the action is discriminatory or not depends upon the motives and basic purposes of top management, and these may be readily controlled by strict adherence to the principle of fair treatment for all.

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Also PARATEX Metal Coating for Steel

PARATEX Metal Coating is ideal for structural steel, steel sash, tanks and all types of steel surfaces inside or out. All that has been said for PARATEX for floors applies to PARATEX Metal Coating. It is easy flowing—easy brushing—and quick drying. Equally important, it's economical.

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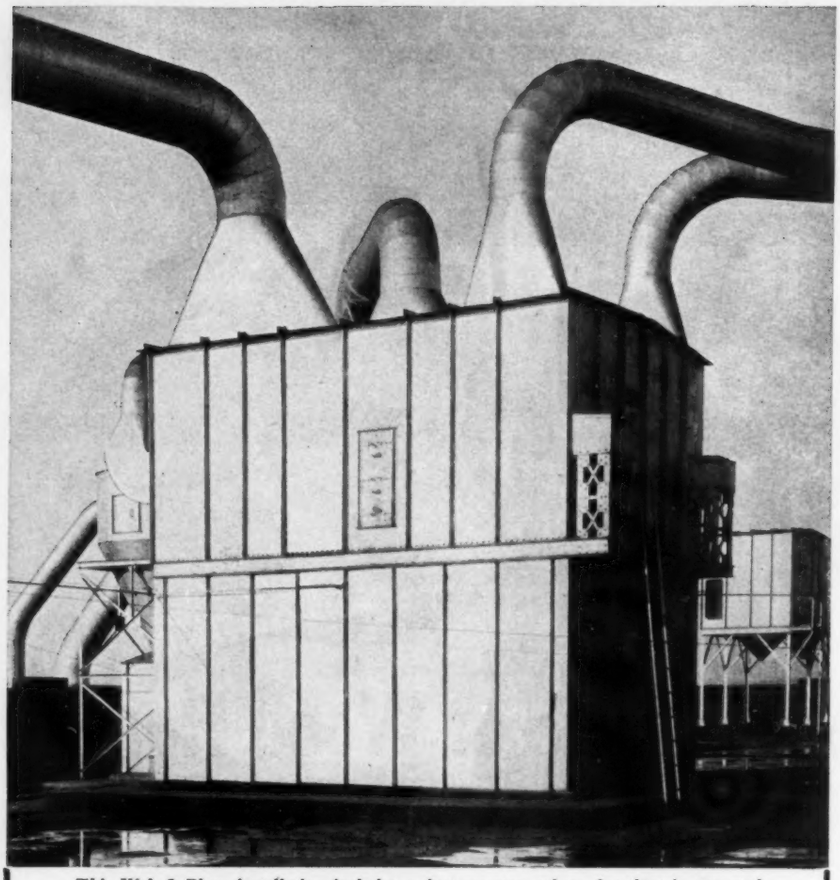

This Kirk & Blum installation includes a dust arrestor, where fine dust is extracted from the exhausted air. By returning the cleaned air into the building, much heat is reclaimed, with consequent fuel savings.

HERE'S A PROFITABLE INVESTMENT . . .

KIRK & BLUM Dust Control Systems *pay for themselves*

Effective Dust Control improves working conditions, steps up efficiency, speeds production, makes possible a better product, protects workers' health, cuts maintenance.

In addition to these results, KIRK & BLUM Dust Control Systems cost less to operate. Amount of suction delivered and power required are definitely guaranteed in writing—your assurance of satisfactory performance.

Kirk & Blum Engineers, backed by over a third century specialized manufacturing experience, have successfully solved the dust control and fume exhaust problems for many industrial leaders throughout the nation. Why not let them help you? Write for details of this service and interesting, illustrated books—"Dust Collecting Systems in Metal Industries", "Blower Systems for Woodworking Plants", "Fan Systems for Various Industries", "Industrial Ovens".

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DUST CONTROL SYSTEMS

They Say and Do

N. J. Defense Firm Shares Profits With Employees

Finding that its defense work has yielded a substantial profit, the Atlantic Products Company of Trenton, New Jersey, has instituted a dividend plan benefiting 500 workers.

On March 28, the first dividend, amounting to about one week's pay, will be included in pay checks.

"Other distributions will be made during the year if conditions permit, and all such dividends will be on a share-and-share-alike basis except for the year-end distribution which will be on a seniority basis as in the past," said Theodore S. Cart, president. The company manufactures leather and canvas goods.

•

Defense Industries Increase Hours And Overtime

Light is beginning to penetrate the weekend blackout in America's defense industries.

A survey of 394 plants engaged in defense work shows that 116 are working six days a week and 68 seven days. Eighty percent are working more than one shift a day and 60 percent of the employees in all the plants studied are working an average of 9.1 hours' overtime weekly.

The survey was made by the Bureau of Labor Statistics at the request of the Office of Production Management, and covered such industries as machine tools, shipbuilding, firearms, ammunition, electrical machinery, brass, bronze and copper products, aluminum smelting and refining, and explosives and engines.

•

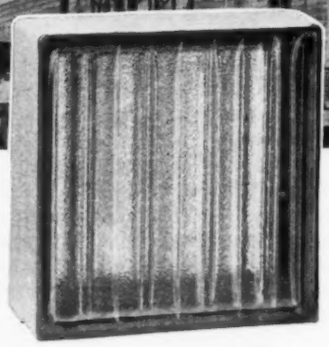
No New Labor Laws Needed, Knudsen Tells Congress

One school of thought in Congress was greatly comforted by the testimony of William S. Knudsen, Director of the Office of Production Management, before the House Judiciary Committee, for Mr. Knudsen declared that new legislation is not needed for the handling of labor disputes in the defense industries.

The Knudsen views found favor with such legislators as Representative Robison, Kentucky Republican, who is one of those generally in support of existing labor laws. On the other hand, Mr. Knudsen's opinions were sharply challenged by Representative Hobbs,

"We're hitting our Schedule on the nose

... thanks to the Architect using INSULUX GLASS BLOCK"



INSULUX speeds erection ---steps up efficiency

In a hurry to build or modernize? Plan, then, on using the *speed-up* building material—Insulux Glass Block.

1. YOU GET IMMEDIATE DELIVERY. Insulux Glass Block are available in any quantity at once, from distributors in every principal city.

2. QUICK ERECTION. Insulux Glass Block are installed quickly, easily, by bricklayers. No painting or "finishing up" needed—just cleaning.

Insulux Glass Block also help you *speed up* after the plant starts operation. Wall panels of Insulux give more efficient light—well diffused, directed deeper into the interior—an aid to sight that lets workers do their best.

More, Insulux has high insulation value that cuts heating and air-conditioning costs. Insulux maintains privacy—prevents prying—eliminates dust and air infiltration. And, needing no painting, Insulux panels cost almost nothing for maintenance.

Your architect or engineer will show you where you can use Insulux Glass Block profitably. Owens-Illinois Glass Company, Insulux Division, Toledo, Ohio.

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THERE ARE PLACES IN EVERY BUILDING THAT *NEED* INSULUX

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Gentlemen: Please send, without obligation, full information on Insulux Glass Block.

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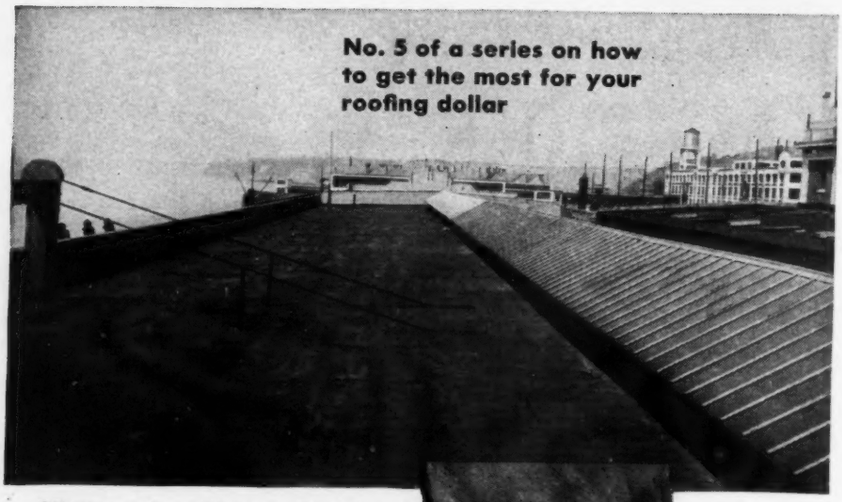
How to tell a good *ROOF*



27 years old **— still in excellent shape. This J-M Smooth-Surfaced Asbestos Built-Up Roof is one of hundreds still giving trouble-free service after the 20-year bond period has elapsed. It's the Bell Street Dock, Port of Seattle, Seattle, Wash.**

See for yourself **how a J-M Asbestos Roof takes care of itself! Scratch the original surface after it has weathered and you'll find black asphalt underneath. You can repeat this test a dozen times in the same spot, with the same results.**

A GOOD ROOF TAKES CARE OF ITSELF

WHEN you buy a built-up roof, ask yourself this question: "How much will I have to spend for resurfacing to protect it from the sun?"

If your choice is a J-M Smooth-Surfaced Asbestos Roof, the answer is: "Not one penny!" And here's why.

Asbestos, being of mineral origin, has the durability of stone. In a J-M Smooth-Surfaced Roof, the asbestos fibers are first felted, then impregnated with waterproofing asphalts to form what is actually a flexible stone blanket, rotproof and fireproof. Obviously, such a roof needs no periodic coating to protect it from the drying-out action of the sun. Result: the lowest possible maintenance costs . . . a roof that virtually takes care of itself!

Furthermore, J-M Engineers anticipate unusual wear at vulnerable spots on your roof. They write specially engineered construction details into the rigid specifications—an extra "factor of safety" that protects your plant and equipment from roof failures. For details and specifications, write Johns-Manville, 22 E. 40th St., New York, N. Y.

JM JOHNS-MANVILLE

ASBESTOS **Built-Up Roofs**

The Roof with the Safety Factor

Alabama Democrat, who is one of those working hard for changes curtailing labor's right to strike on defense work.

Knudsen, a veteran in collective bargaining, expressed hope that the leaders of large industrial unions will become "more conservative" as they become more experienced, and that management will increasingly "decide to accept the laws on the statute books." He did express approval of a "cooling off" period, but held that this could better be arranged by contract agreement between employers and employees rather than by law.

On the question of anti-strike legislation, the OPM Chief was emphatic.

"You can't make a man a criminal because he is striking," he said.

By and large, Knudsen was optimistic about the labor outlook in the defense industries and disinclined to regard the strife so far experienced as a serious setback. The Vultee Aircraft strike did hold up production for three weeks, he said, and was the most serious of all.

Representative Michener, Michigan Republican, who is pretty much in agreement with Representative Hobbs, questioned Knudsen quite sharply about the General Motors strike of 1936 when, Michener said, "Knudsen went hat in hand to the union in Flint to get the plant back."

Knudsen parried the thrust.

"The National Labor Relations Act brought about that strike and you men in Congress put that law on the books," he declared.

While not professing to be satisfied, Knudsen said he thought "defense production was getting cooperation both from capital and labor but that the urgency of the program was perhaps not fully realized." Summing up his views on anti-strike legislation, he said:

"Although some conditions are interfering with the defense program, the passage of any legislation might make the situation infinitely worse."

•

More Liberal Interpretation of Compensation Laws Seen

It is apparent that the trend of judicial opinion is toward a liberal interpretation of our compensation statutes, in providing compensation for those injuries to health that are peculiar to the employment, and may be aggravated by conditions of the employment. It is also apparent that in those states having general-coverage occupational disease compensation laws, compensation will be awarded for health impairment that is common to everyday life, provided there is medical testimony in the case expressing the opinion that the injuries so

sustained may have been caused or aggravated by the conditions of employment. If this tendency continues, substantial unanticipated expense will be imposed upon employers and their insurance carriers because of awards for tuberculosis, pneumonia, asthma, and other similar respiratory diseases.

During the state legislative sessions of 1941, we shall find, undoubtedly, that many bills relating to this subject will be introduced and pressed for enactment, proposing to liberalize benefits and broaden the scope of compensation coverage.

These developments emphasize the fact that it has become and will continue to be good business for industry to concern itself with the protection of the health of industrial workers and, in giving consideration to the legal responsibility that arises from injuries to that health, we come to the full appreciation of the importance of comprehensive programs for industrial hygiene.—*Theodore C. Waters*, chairman, Maryland Occupational Diseases Commission, at the Fifth Annual Meeting of Air Hygiene Foundation of America, Inc.

•

Johns Hopkins Offers Courses for Material Inspectors

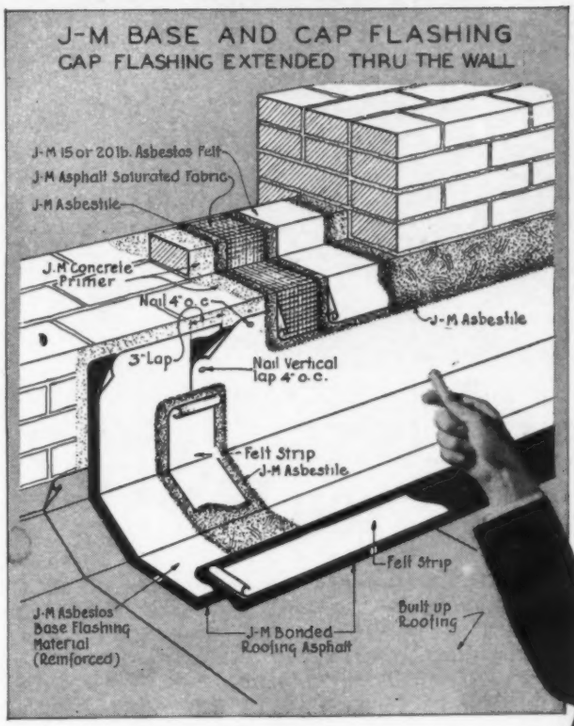
The Johns Hopkins University is offering ten courses of college grade under the sponsorship of the Engineering Defense Training Program. These courses are under the supervision of W. B. Kouwenhoven, Dean of the School of Engineering. Among the courses offered is a full-time day course designed for the training of material inspectors, and arranged at the request and with the cooperation of the Ordnance Departments of the Army and Navy. The subjects included are Engineering Materials and Metallography, Elements of Structural Design, X-Ray and Gamma Ray Radiography, Magna-Flux Testing, and Production Methods. The work will include both lectures and laboratory practice. Classes for material inspectors began on February 3, 1941. Successful completion of the course will be accepted by the United States Civil Service Commission as equivalent to one year's experience.

•

Armco and Wright Cooperate in Training Project

The Wright Aeronautical Corporation has opened a training school for machinists in Middletown, Ohio, in a building provided by The American Rolling Mill Company. Several hundred men will be trained in this school. After a training period of from two to three months, those who complete their training satisfactorily will be eligible

How to tell a good ROOFER



The diagram **at left illustrates one type of J-M "Through-the-Wall" Flashing, designed to give you extra protection at the points where 75% of all roof leaks start. On all work that calls for this type of construction, J-M Approved Roofing Contractors follow these rigid specifications to the letter.**

A GOOD ROOFER FOLLOWS SPECIFICATIONS TO THE LETTER

THERE are at least five "critical areas" in every built-up roof . . . and short cuts in construction details at these spots may prove costly. J-M Approved Contractors know this—that's why they adhere strictly to the high standards set by J-M Engineers. An extra "margin of safety" is carefully engineered into the rigid specifications, assuring ample protection at all vulnerable points on your roof.

That's just one of the many high standards set up by Johns-Manville to help you get a longer lasting roof. Furthermore, every J-M Contractor must have highest qualifications of past experience, ability and integrity before he is accepted as an *Approved Roofer*.

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So, before you buy a new roof, see your local J-M Approved Roofing Contractor. You'll get a better built-up roof, with trouble-free service for years to come. For his name and address, consult your classified telephone directory or write Johns-Manville, 22 E. 40th St., New York, N. Y.

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APPROVED **Roofing Contractors**

Selected for their Ability and Integrity

ARE WIRE FAILURES DRIVING YOU NUTS?

Are shorts knocking out your dried out, age-wizened lighting circuits? Are oil-rotted motor leads quitting on you and tieing up production? Are your power and control cables getting as brittle as macaroni in the hot spots? Are you hopping from one rewiring job to another *and then going back to do the same thing all over again?*

If that's your situation don't blame operating conditions that you can't change. What you need is a wire designed especially for severe service—one that will prevent illumination blackouts, machine outage, lost production and unnecessary maintenance expense! And that's just what you'll get if you wire with Rockbestos because every wire, cable and cord in the line is *permanently insulated* against the service interruptions caused by heat, fire, alkalies, caustics, corrosive fumes, moisture, oil, grease and aging.

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Also refer to McGraw-Hill Electrical Buyers Reference.

New York, Pittsburgh, Buffalo, St. Louis, Cleveland, Los Angeles, Detroit, San Francisco, Portland, Ore., Chicago, Seattle

Rockbestos 600 Volt All-Asbestos Power and Rheostat Cable — No. 18 AWG to 1,000,000 CM — one of 118 different permanently insulated wires.

for positions in the new airplane engine plant now under construction at Lockland, Ohio, within commuting distance of Middletown.

The idea of establishing a training school here was proposed by the steel company to W. W. Finlay, manager of the Wright plant at Lockland, and to other officials of the Wright corporation. Being faced with the tremendous task of selecting and training more than 11,000 skilled workers, they accepted the offer of cooperation and the details of the training school were worked out jointly.

Men to take the defense production training are being selected by aircraft engine company employment officials from a group of employees on the Armco payrolls made available by changes in manufacturing processes. Changing demand for flat-rolled steel products has caused Armco to undertake a program of modernization and construction extending back over several years. With the completion of this program in sight, the company was desirous of assisting men affected by the changes to secure regular employment, and at the same time the company was anxious to cooperate with those bearing the burden of defense production.

Roy W. Jenkins, supervisor of training for the aircraft engine company, will be in charge of training activities. He was formerly assistant supervisor of vocational education for the State of Ohio.

Actual production machinery has been installed on which to train the machine operators. Men will be trained in groups of approximately 50, divided into day and night sections to permit their receiving instruction in periods when they are not working on their regular jobs in the steel plant.

First steps in the training program will be devoted to subjects related to machine shop practice, such as shop mathematics, measuring tools, operation sheets and blueprint reading, and shop science. Then will follow an intensive period of practical training in actual machine shop practice.

•

NLRB Moves to Improve and Speed Up Its Operations

The National Labor Relations Board has announced changes in its administrative organization and procedures designed to improve and speed up its operations.

A new administrative division has been set up to direct and supervise the work of the Board's 22 regional offices and to oversee the issuance of complaints and authorization of proceedings in representation cases.

The method of reviewing records of

HOW A MODERN POWER PLANT EFFECTS 3 IMPORTANT SAVINGS

1. *STEPS* 2. *TIME* 3. *MONEY*

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1. PRODUCTION—Instant communication along production lines, between control positions, between floor and moving cranes, between office and warehouses. Facilitates the orderly movement of raw and finished materials to accumulation points. Intelligible instruction to personnel *above* extreme noise levels in mills, shops and foundries.

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Write or send coupon for full details about custom engineered RCA Victor industrial sound systems, available for any desired number of loudspeaker outlets. If you wish, a specially trained RCA sound engineer will help you solve any sound coverage problem.

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We will be glad to supply information concerning scores of other RCA Victor industrial installations.

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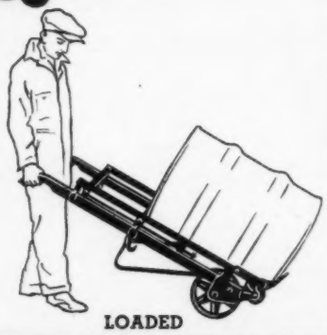

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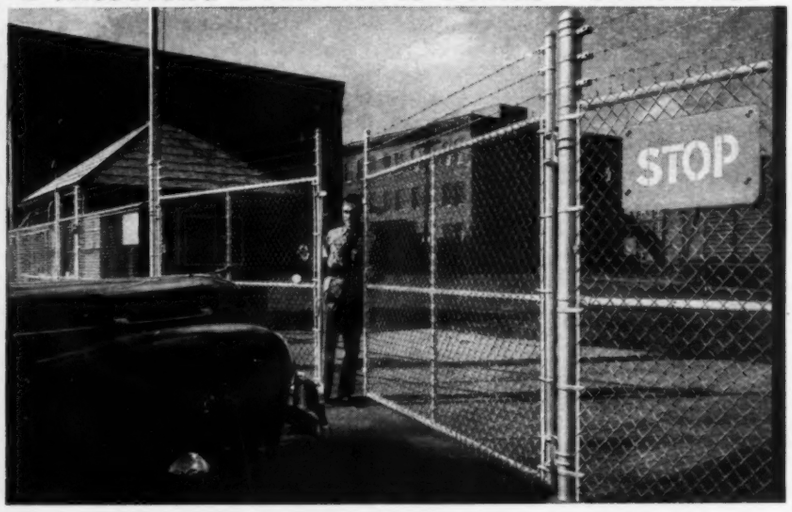


SERVICE AS LOCALIZED AS YOUR OWN POST OFFICE

★ The postal service in your town is based on training, responsibility and knowledge of local facts. So it is with Page Fence service. It is rendered by 102 local, responsible firms having factory training and long experience. You can rely on the Page Fence engineer because he knows local conditions. He will recommend the right fence style and the choice of four metals best suited to your needs. Only Page distributors can offer that choice and supply the stronger Winged Channel Posts. Write for "Fence Facts" and name of nearest Page Fence distributor, to PAGE FENCE ASSOCIATION, Bridgeport, Conn., Atlanta, Chicago, New York, Pittsburgh, or San Francisco.

A PRODUCT OF PAGE STEEL & WIRE DIVISION—AMERICAN CHAIN & CABLE COMPANY, INC.

hearings has been changed so as to throw greater responsibility on the trial examiners and review attorneys.

The new administrative division in charge of regional offices and case development will take over a part of the duties heretofore entrusted to the secretary of the Board. The director of the new division will report and be responsible directly to the Board and, since he will not be a subordinate of the secretary, he will have correspondingly greater authority than the chief administrative examiner has had. Garnet L. Patterson, formerly regional director in Chicago, has been brought to Washington and placed in charge of the new division.

Mr. Patterson will have under him three or four regional coordinators, each of whom will be responsible for overseeing the work of a number of regional offices. They will also upon request assist the regional directors in pressing situations and in handling special problems. In addition to these traveling coordinators there will be under Mr. Patterson another three or four administrative examiners to handle the work of case development in Washington. A survey of the work and personnel of the regional offices has already been begun by Mr. Patterson with the assistance of a committee of regional directors. The Board expects this survey to be completed by March 1, and it may then change the boundaries of some of the regions and make such other changes as may be needed.

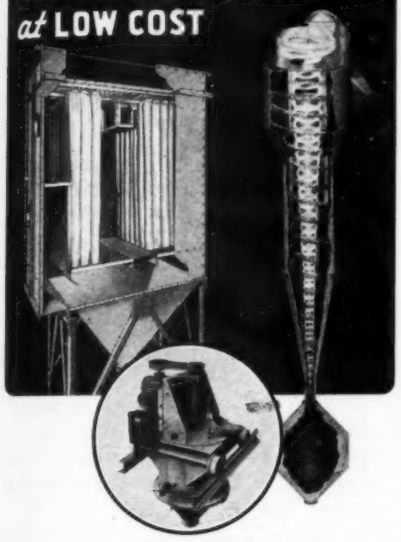
Promotions From Within

It is expected that some of the more experienced regional directors will be promoted to the positions of regional coordinators, and that new regional directors will then be chosen largely from among the best of the staff in the regional offices. So far as possible the Board will pursue the policy of promoting from within to fill vacancies in higher positions and to hire new personnel for the positions in the lower grades. By this system of promotion, persons already experienced in some aspects of the Board's work will be able to bring this experience to bear on their new job. With a thoroughly trained field staff thus achieved, working under the direction and with the assistance of traveling coordinators, the Board hopes to be able to decentralize its work by delegating more responsibility to the regional directors along the lines of the recommendations of the Attorney General's Committee on Administrative Procedures.

The trial examiner's intermediate report, as heretofore, will be checked by an independent analysis of the record by the review section. The intermedi-

which does your problem need— WET or DRY DUST CONTROL?

We can give you BOTH with HIGH EFFICIENCY at LOW COST



THERE are two very good reasons why it will be to your advantage to see us about your dust collecting problems. First, we can supply you with either a wet or a dry system; secondly, you pay no premium for the high efficiency of an *American* collector.

Illustrated are two dry type *American* collectors—the "Dustube" cloth bag type and the "Cyclone." These units are notable for their unusually high efficiency. The "Dustube," for example, is more than 98% efficient by weight; and by dust count, the discharged air shows less than ten million particles from two to ten microns in size. The "Cyclone," because of its distinctly improved design, is far superior to the average cyclone in efficiency; and it compares well with the average wet system, though it is much less expensive.

The Wet Disposal Unit, also illustrated, can be added to either of these two collectors, or any other dry type of collector, for discharging accumulated dust as a wet sludge.

AMERICAN FOUNDRY EQUIPMENT CO.

374 S. BYRKIT ST. MISHAWAKA, IND.

ate report and the analysis of the record by the review section will be considered by each member of the Board, who will also have available for consideration therewith the entire record, including exhibits, exceptions to the intermediate report, and the briefs.

It is hoped that the Board will be able to place increasingly greater reliance on the intermediate reports and thus save time in the preparation of decisions.

The removal of case development work and supervision of regional offices from the jurisdiction of the secretary will make the secretary's function primarily that of an office manager. He will handle general correspondence, other than that relating to cases, and have charge of the clerical staff in Washington. He will prepare the Board's agenda and keep the Board's records. Case statistics will be under his direction. He will also be the Board's fiscal agent and budgetary officer.

•

Caterpillar Goes on the Air to Report to Employees

Announcer: This is Brooks Watson speaking. The following half-hour program comes to you from the studios of WMBD. We have with us here in the studios the president of the Caterpillar Tractor Company, who will discuss the annual report of their company to its stockholders and employees. It gives me great pleasure to present Mr. B. C. Heacock.

Mr. Heacock: Thank you, Brooks. It was just a year ago tonight that I was here in the studios of WMBD reporting to Caterpillar employees on the preceding year's operations.

Thus, on Wednesday evening, February 5, Caterpillar management went on the air for the second time to interpret its annual report to the company's 12,000 employees.

Said Mr. Heacock in his report:

"I'd like to have you take a look at the chart at the bottom of page 9. That shows the course of hourly wage rates since 1927. You will note that since 1933 they have climbed steadily until in 1940 they reached a point of 34 per cent higher than in 1927. That has been a direct increase in the costs of manufacturing and a direct increase in the wages employees receive per hour of work, but of course it doesn't increase by the same percentage the amount in the weekly pay envelope because at the same time we have been increasing the hourly rates, legislation has acted to curb the number of hours of work per day and the number of days per week. We all have to realize that we can't eat our cake and have it, too. To gain more leisure we have

"Why WE CAN SHIP FASTER AND SAVE MONEY AT THE SAME TIME"

"The use of containers developed for us by General Box engineers eliminates the delays, unnecessary costs and damage so frequently experienced when ordinary shipping containers were used."

Today, most customers are demanding faster delivery. Manufacturers of scores of different types of products have increased their shipping speed *and* reduced their packing, handling and shipping expense by using the facilities of the General Box laboratories. Here the container best suited to meet each requirement is recommended or designed.

Don't burden your products with extra costs and run the risk of customer dissatisfaction. Get the facts about this free General Box service now.

THIS FREE BOOK TELLS HOW

— products similar to yours are packed and shipped faster, more economically, in General Boxes and Crates. Mail the coupon for your copy.

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General Offices: 504 N. Dearborn St., Chicago, Ill. *District Offices and Plants:* Brooklyn, Cincinnati, Detroit, Kansas City, Louisville, Milwaukee, New Orleans, Sheboygan, East St. Louis, Winchendon. Continental Box Company, Inc.: Houston, Dallas.

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504 N. Dearborn St., Chicago, Ill.

Gentlemen: Send, without obligation, free copy of the new manual "How Research Can Save $$ for You."

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Skilled Machinists Hard to Find?
Let KENNAMETAL Tools Help Solve Your Problem

Style No. 11 Tool with Chip Breaker

If increased business is taxing your production capacity—and you can't get the men or machines to make deliveries on time—install KENNAMETAL-tipped tools on your present machines for turning, boring and facing steel. KENNAMETAL tools can approximately *double* the production of your present machines, and output per man—and they can be installed almost overnight.

Furthermore, by tooling up with KENNAMETAL, you will help prevent layoffs in your factory—and open the road for further employment—when the war has ended. For European plants are now using carbide-tipped tools wherever possible and will capture most of the world markets for metal products—unless we can cut costs by adopting the same efficient production methods.

Write today for your free copy of Bulletin No. 740 which explains KENNAMETAL in detail. Please give company name and your title.

McKENNA METALS Co.
130 LLOYD AVENUE
LATROBE, PENNSYLVANIA, U.S.A.

REDUCE METAL TURNINGS

TO UNIFORM SIZE *With* JEFFREY CRUSHER

ADVANTAGES:

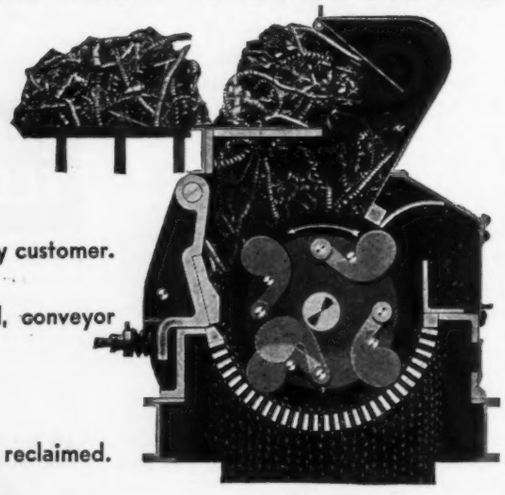
Uniform size chips preferred by customer. Bring a better market price.

More easily handled — shovel, conveyor or magnet.

Greatly reduces volume.

More tonnage per car.

Oil or cutting compound easily reclaimed.



(Patented)

Cross-section of Jeffrey steel turnings crusher above. At the left may be seen two types of steel crushing elements, the cloverleaf and the Flextooth. Furnished with top feed or side feed.

Our Reduction Division will be glad to go into details

THE JEFFREY MANUFACTURING COMPANY

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New York, Boston, Buffalo, Philadelphia, Pittsburgh, Scranton, Huntington, Cincinnati, Birmingham, Cleveland, Detroit, Chicago, St. Louis, Houston, Terre Haute, Milwaukee, Salt Lake City, Denver, Baltimore

given up some hours of work and when we as a nation choose, instead of working 48 or 44 hours a week, to work 40 or 36 or some other lesser number, we are simply producing less, creating less of the things which constitute our standard of living."

•

Contract for Dress Industry Calls for "Efficiency"

Newest collective bargaining agreement between unions and employers requires the latter to operate their shops efficiently. It is the agreement signed in New York on February 19 by the Joint Dress Board of the International Ladies Garment Workers Union and four employer associations.

The three-year contract for New York City's largest industry—it employs 85,000 organized workers and has an annual trade volume of $350,000,000—provides:

1. That workers, through the union, have the right to secure efficient shop management from their employers.

2. That during the term of the agreement employers and labor will cooperate in raising from $3,000,000 to $4,500,000 to promote the industry and establish New York City as the fashion center of the world.

3. That an "efficiency department" will be set up in the office of the industry's impartial chairman to assist employers in improving the efficiency of their shops.

A fifth employers group, the United Better Dress Manufacturers Association, representing 700 contractor shops employing 25,000 workers, has refused to join in the agreement on the ground that the efficiency clause was "vague" both as regard to violations and penalties prescribed. Threat of a stoppage by these 700 contractors hung over the industry, even as the agreement was being signed, as a result of the union's efforts to prevail upon jobbers to eliminate the contractors altogether by establishing their own "inside" shops and upon manufacturers to expand their facilities. The union claimed all it was doing was trying to prevail upon other employers to give jobs to workers in shops refusing to accept the conditions of the new agreement. It was reported that the union had obtained such jobs for 10,000 of the 25,000 employed in contractor shops.

•

High School Students Learn More About Business

What's going to happen to American business after the war is over, and how can I get a job?

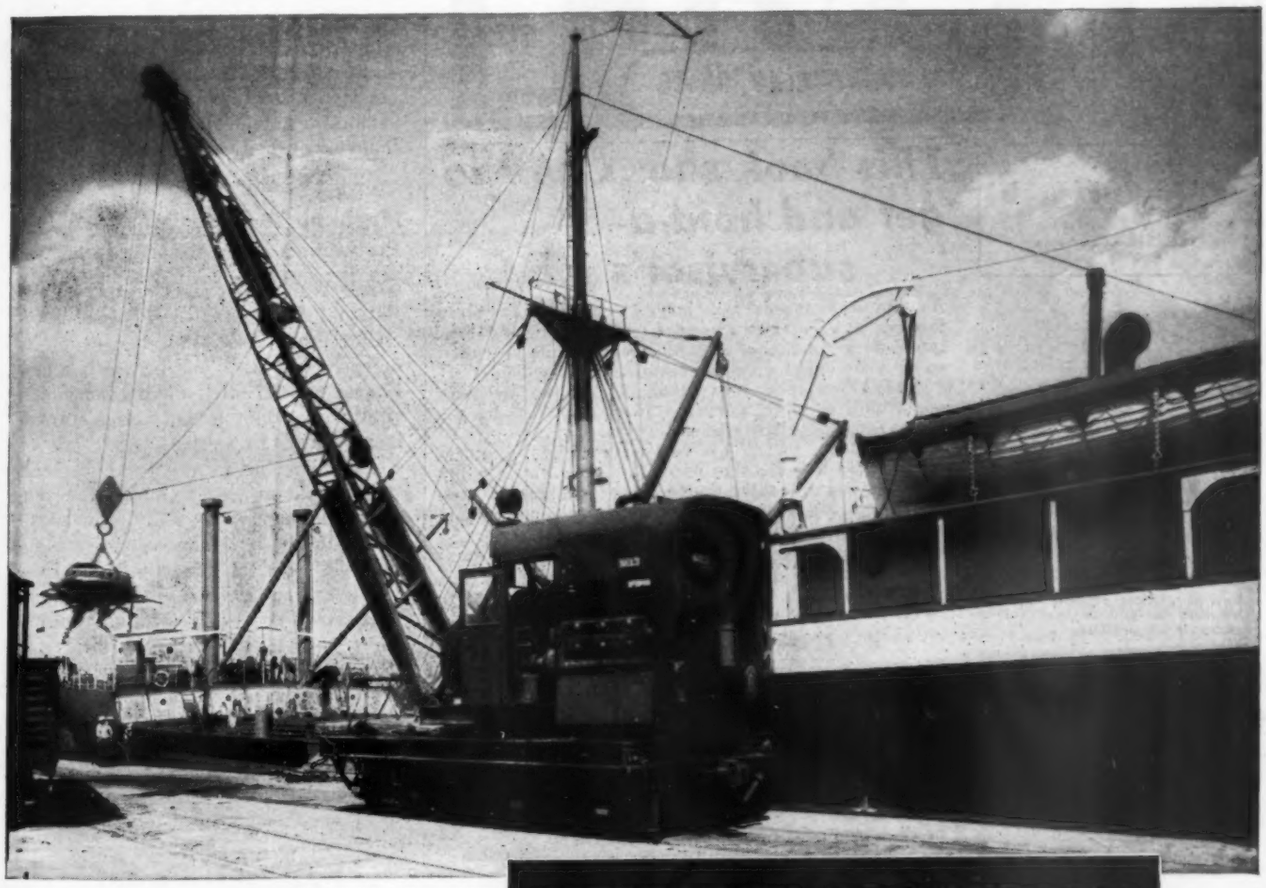
These were the two outstanding

"Industrial Brownhoist Diesel Cranes Cut Handling Costs"

The Houston Compress Company have been using a 25-ton Industrial Brownhoist Diesel crane for handling steel scrap from cars to boats for the last 3½ years. A recent check revealed that during an 81-hour period this crane's oil consumption was only 110 gallons at a total cost of $6.60 or less than 66 cents per 8-hour day!

A large mid-western steel mill has been operating a similar crane for approximately four years. In this time it has worked 12,877 hours, consuming an average of only 1.88 gallons of fuel oil at a cost of approximately 11 cents per hour! And not only has this crane operated economically, but it has handled 710,175 tons of pig iron, switched cars and loaded as much as 1,500 tons in one 8-hour shift and yet it has been down for adjustments only 175 hours in its life-time. Thus its availability for productive work has been 98.78%!

Lower fuel costs, greater output, longer life and greater "availability" are the four advantages you always get in an Industrial Brownhoist Diesel crane. *Investigate today how these cranes can help cut your handling costs.*



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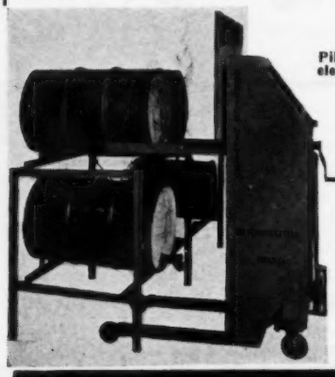
INDUSTRIAL BROWNHOIST

CRANES • SHOVELS • BUCKETS

JOIN THIS PROFITABLE

UPLIFT MOVEMENT

There's a great "lift" in finding new storage space to save the cost of building new warehouses. Service Lifters can "enlarge" your crowded storage space.



Piling boxed electric ranges 3 high

PORTABLE LIFTERS

They go where you want them on Service easy rolling casters. When spotted they lift or lower, mechanically or electrically. Model shown above is telescopic, one section rising out of the other to 11 feet and over, capacity 750 lbs. Can be built to any size, and speed of lift. Write us for illustrated description of models.

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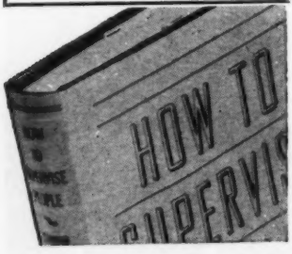
505 N. Brownswood Ave., Albion, Mich.

Eastern Factory: 434 Somerville Ave., Somerville (Boston), Mass. Toronto, Canada: United Steel Corporation, Ltd., SC&T Co. Division.

SERVICE

MATERIALS HANDLING UNITS

More foremen needed . . .



This book shows how to get and hold a supervisor's job

As industry speeds up, larger forces mean more foremen . . . Foremen's problems in handling different types of men increase . . . Supervisors will be called on to train more men in operations and policies.

And so on . . . everything adding up to more opportunities, more pay, for men who can handle supervisory positions efficiently.

What about you? Do you want to get a supervisor's job, or make the most of the one you are in? Now, at just the right time to help you, a new book appears . . . a straight out, practical, quick-study manual of supervision methods that work.

JUST OUT—TELLS YOU

—how a worker should conduct himself to get in line for a supervisory position

—how to analyze a supervisory job to learn its specific responsibilities and their relative importance

—how to handle problems of employee health and safety

—how to keep up employee's interest in his job, satisfaction with it, and loyalty to it

—qualities the supervisor should develop to make his leadership more effective

—how to secure cooperation of subordinates and superiors

—how to hire and fire

—how to reprimand

—what work to delegate to others; how to keep a check on it

—how to train men, individually or by conference method

Alfred M. Cooper's

HOW TO SUPERVISE PEOPLE

145 pages, 5x7¼, $1.75

Gives you recommended methods of handling situations foremen and executives encounter daily in their work. As educational advisor to many big firms, author has discussed personnel problems with thousands of experienced supervisors; in this book he brings you solutions they agree get best results.

Concise, easy to read and understand. Gives you quickest sort of training for better results in supervision. Send for a copy today.

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Send me Cooper's How to Supervise People, for 10 days' examination on approval. In 10 days I will send $1.75, plus few cents postage, or return book postpaid. (Postage paid on orders accompanied by remittance.)

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(Books sent on approval in U. S. and Canada only.)

questions of 1,000 high school students who met on January 16 at Springfield, Mass., with leading industrial executives at the nation's first "High-School-Student-Business Conference." The meeting, first of a series to be held during the winter, was initiated to develop a better understanding of the problems and policies of free business enterprise and their relation to American democracy.

Major speakers were Mayor Roger L. Putnam, and George A. Mohlman and Roe S. Clark, vice-president and treasurer respectively of the Package Machinery Company. M. Marcus Kiley, school principal, presided. Immediately following their talks a question-answer period was held.

Main interest of the students at this conference centered upon opportunities for youth in business, improvement of union and management relations, and type of training youth should undertake to prepare for a business career.

Some typical questions asked by the students were: "Should the President have the right to stop strikes that interfere with national defense?" Mayor Putnam's answer, "Yes, absolutely," was loudly applauded. A young lady who asked whether wives should work after marriage was advised to ask her future husband. Other questions: "Will we have a depression after the war?" "Should a boy go into a large or small company when entering business?"

•

Machine Tool Group Speeds Production of Shells

The War Department turned to the National Machine Tool Builders' Association, the Association turned to its defense committee, and presently a new line of special shell-making machines, vitally important to the nation's armament, was born.

These machines, which can be built quickly in any well-equipped manufacturing shop, are now in production—a significant example of private industry's speed and ingenuity in cracking a critical defense bottleneck.

Plants not now engaged in defense work, such as printing press or textile machinery producers, can, with little adjustment, make these machines from designs originated and tested by the machine tool group. This will take part of the defense load off the machine tool industry and leave it free to concentrate on other much-needed equipment for aircraft engines, tanks, guns, and similar items requiring machine tools for precision operations.

Shell manufacture is not precision work. The closest limit on a shell is 5 thousandths of an inch while most limits are 20 to 30 thousandths.

The National Machine Tool Builders'

G-E *Hook-on* Instruments Make A-C Measuring Easier

THE G-E hook-on volt-ammeter is the handiest of all instruments for general plant testing—particularly where you need an accurate measurement of circuit conditions in a hurry.

Just hook the AK-1 around a conductor, flick the selector switch to "AMPERES" and you have your measurement. To measure volts, connect the voltage leads, snap the switch to "VOLTS," and take the reading.

ACCESSORIES FOR CONVENIENCE

1. An attractive, black-leather carrying case is available.
2. An extension pole can be supplied for reaching into inaccessible places and for additional protection on high-voltage circuits.
3. Voltage leads are included with each instrument.

AND A LOW-COST HOOK-ON RECORDER FOR CONTINUOUS RECORDS

For trouble investigations and maintenance — where a permanent record of a-c circuits is needed—this G-E hook-on current-measuring set is ideal. It consists of a Type CF-1 recording ammeter and a split-core current transformer.

IT'S INKLESS—ready to go at a moment's notice—no inkwell to fill, no pen to start, and no ink to spill and blur the record.

The set is simple to use—just connect the CF-1, close the jaws of the transformer around a conductor, and it starts to record. The instrument operates without attention and has a 30-day chart length. Timing of the chart drive is accurately controlled by a Telechron motor.

Type CF-1 inkless recording voltmeters are also available.

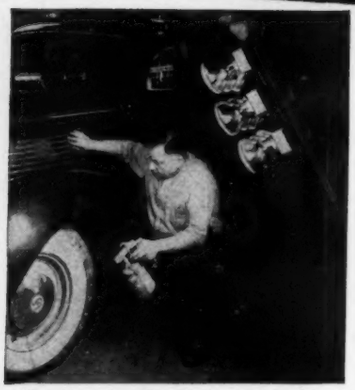
For further information on the hook-on voltammeter, ask for Bulletin GEA-2950; on the recorder, GEA-3187. Your G-E office has copies, or write to General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

602-20

BANISH BOTTLENECKS due to DRYING DELAYS!

with WESTINGHOUSE RADIANT HEAT DRYING LAMPS



Portable radiant heat drying rack used in shop where a body repair gets 3 prime coats and 3 finish coats of paint. Former drying time per coat: about 1½ hours. Radiant heat time: 20 minutes!

● FASTER! . . . CHEAPER! . . . EASIER!

No wonder business everywhere is turning to this new, economical way of heating and drying! Radiant heat *penetrates* the surface finish or film, causing more rapid drying of lacquers, paints and enamels. Greater speed plus lower installation and maintenance costs have resulted in lower total processing costs, fewer "bottlenecks" due to drying delays.

● STARTS AT THE FLIP OF A SWITCH

Radiant Heat being of the same general nature as visible light is as easily controlled. A flip of the switch and the heat is there in full force. No delay. No elaborate insulated ovens or time-consuming pre-heating. See your local Westinghouse Mazda Lamp distributor or write for folder, Westinghouse Lamp Division, Bloomfield, New Jersey.

Westinghouse

RADIANT HEAT DRYING LAMPS

PENCO "Over-time" is Yours!

1869 Penco FOR PERMANENCE

Low Cost Penn-Kelsey Lockers Do Double Duty

New type lockers accommodate ten persons per unit in half the floor space ordinarily required. *This extra, released floor space can be used for productive purposes.* Each low-cost portable unit has perforated metal shoe rack at bottom, a wooden seat attached to frame and ten private, locked compartments. Permanently attached coat hangers. Maximum ventilation. Overall size: 60" wide, 18" deep, 87" high. Write for details.

PENN METAL CORPORATION OF PENNA.

26 Oregon Ave., Philadelphia, Pa.

In Business Continuously Since 1869

P E N C O Products are Steel Shelving, Cabinets, Lockers, Small Parts Bins, Tote Boxes, Shelving Trucks, Steel Counters and Tables, Corrugated Culvert Pipe and Metal Specialties.

designs comprise two basic machines, each standard for all the turning, boring, and facing operations involved in making shells of the 3-in. and 6-in. caliber groups. Each basic machine can be equipped with slides, tailstock, tooling equipment, and motor drive required for specific operations. The machines can do everything except cross drilling, notching, nosing-in, squeezing the band into the band seat, and welding the base end-plate.

Unskilled Men Can Run Them

Not only are the new machines so simply designed that they can be built quickly in large numbers, but they are inexpensive and can produce shells economically. Automatic as well, they can be operated by unskilled men. All are single-speed units except for a few that require two-speed motors. The motors vary from 10 to 60 horsepower.

To simplify construction, the plans eliminate all large planing and boring operations and all machining operations on the main casting, except for the drilling of a few small holes. The carriage for the turning tools and the swinging arms for facing operations are supported entirely on longitudinal bars instead of planed way surfaces. There are three of these bars and all of them, as well as the spindle, tailstock sleeve, and all shafts, are carried by bushings which are cast in place in the main base of the machine.

The engineering work was done under direct supervision of Myron S. Curtis, consulting engineer in machine design.

•

January Electric Truck Bookings Up 222 Percent

January bookings of electric industrial trucks and tractors dropped somewhat from the peak reached in December of last year. Figures released by The Industrial Truck Statistical Association, 208 South LaSalle Street, Chicago, reveal that 261 units were booked during January, an increase of 222 percent over the same month of last year.

Total net value of chasses only booked was $889,440.50, an increase of 228 percent over the value of bookings during the first month of 1940.

Fourteen non-elevating platform trucks, with capacities and base chassis prices ranging from 2,000 to 6,000 pounds and $1,250 to $1,980 respectively, had a total net value of $25,560. All net values shown are at factories, after additions and deductions for variations from standard specifications, trade-in allowance, etc., when applicable. There were also 218 cantilever trucks, with capacities and

"Damn the Torpedoes-
FULL SPEED AHEAD!"

● Those were the famous words of Farragut at the battle of Mobile Bay. And today, with the orders "full speed ahead" again ringing across the country, all barriers must be conquered—for from every quarter the demand is for greater speed, greater output.

But what avail are increased production schedules, faster assembly lines, standardized processes, if manufacturing is halted by a barrier at the end of the line—slow, outmoded equipment in the finishing department! What avail is greater operating efficiency if new departments—even new plants—are held out of production while they wait upon old-fashioned methods of maintenance painting? Output can't be speeded anywhere along the line unless product finishing and plant maintenance move at the same pace.

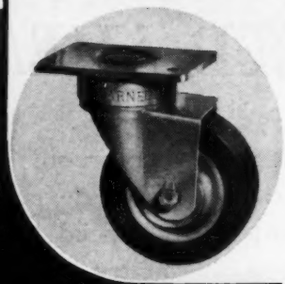
Modern DeVilbiss Spray Equipment breaks the barrier that holds back industrial progress. It does its job efficiently—and at a saving. Let us send a DeVilbiss man to your plant for a check-up. There is no obligation.

THE DEVILBISS COMPANY • TOLEDO, OHIO
Canadian Plant: WINDSOR, ONTARIO

DEVILBISS
SPRAY SYSTEMS

THE COMPLETE DEVILBISS LINE CONSISTS OF: Spray finishing equipment • Automatic coating machines • Tanks for spray materials • Spray booths and exhaust fans for vapor and dust elimination • Air regulators, cleaners and dusters • Air compressors • Respirators • Specialized hose for paint, air, water, gasoline, welding and pneumatic tools • Hose connections • Water and oil guns • Equipment to prevent offset in printing • Paint stripers • Medicinal atomizers • Perfume atomizers.

DARNELL CASTERS & WHEELS

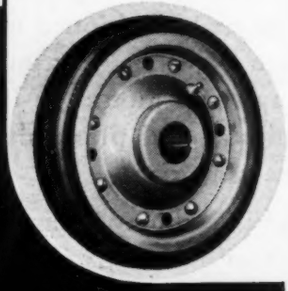


A SAVING AT EVERY TURN

Maximum Floor Protection

Increased Employee Efficiency

Longer Service for Equipment



4000 models from which to choose. All Darnell Casters and Wheels are pre-tested for efficiency and durability—you are assured a long life of satisfactory service. Write for FREE MANUAL.

DARNELL CORPORATION, LTD.
STATION B., LONG BEACH, CALIFORNIA
36 N. Clinton, CHICAGO — 24 E. 22nd, NEW YORK

base chassis prices ranging from 1,000 to 25,000 pounds and $1,200 to $13,865 respectively, with a total net value of $757,548.50; 13 tractors, with capacities and base chassis prices ranging from 600/1,200 to 2,500 pounds drawbar pull and $1,395 to $1,960 respectively, had a total net value of $20,980; 7 crane trucks with capacities and base chassis prices ranging from 2,500 pounds at 7-ft. to 10,000 pounds at 5½-ft. radius and $5,000 to $7,450 respectively, had a total net value of $39,567; 9 special trucks, scoop shovel, sheet and paper handlers, with capacities and chassis base prices ranging from 2,000 to 20,000 pounds and $3,885 to $6,315 respectively, had a total net value of $45,785.

•

BOOKS

FIRE FROM THE AIR

J. Enrique Zanetti, Professor of Chemistry, Columbia University. Columbia University Press, 2960 Broadway, New York. 55 pages, diagrams, tables, bibliography. 50c.

Pocket-size booklet, consisting of material from lectures delivered to professional fire and police specialists on the subject of wartime incendiary bombs, discusses those materials used in airplane bombs. It points out the materials which will most likely be used in the future, their properties as fire agents, and the probable circumstances of their employment. Features of those bombs which have carried over from the last war are explained. The booklet is written for the layman and uses non-technical terminology.

CONSCRIPTION LAW AND REGULATION

Commerce Clearing House, Inc., 214 North Michigan Ave., Chicago. 147 pages, index. $1.

Exact texts of the more important statutes and administrative provisions pertaining to the "conscription" laws now in force are gathered together so that the individual called for military training may readily see how his business and other relationships are affected. Reproduced in full are the Selective Training and Service Act of 1940, National Guard and Reserve Officers Mobilization Act, Soldiers' and Sailors' Civil Relief Act of 1940, the six "Volumes" of Selective Service Regulations released to date, and the Selective Service Questionnaire.

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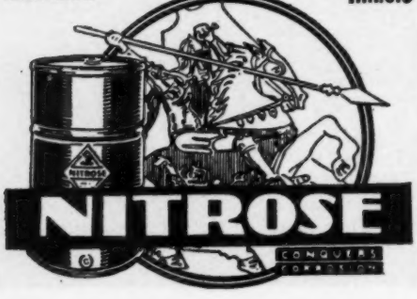

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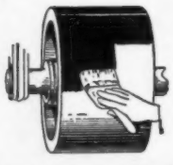

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GUIDE TO LIBRARY FACILITIES FOR NATIONAL DEFENSE

Edited by Carl L. Cannon for the Joint Committee on Library Research Facilities for National Emergency. American Library Association, 520 North Michigan Ave., Chicago. 235 pages, index. $1.25.

Preliminary edition. Listing of library research facilities for the national emergency covers the principal collections relating to war industries and defense preparations that are available throughout the country. Under such broad headings as aeronautics, agriculture, chemicals, commodities, electricity, engineering, labor and laboring classes, safety, scientific instruments, the material is set up. Subheads divide each field and under those divisions the libraries are arranged according to regions of the country. A directory of all libraries participating in the survey follows the text.

TAKING THE MERCHANDISE INVENTORY

James J. Jackson, Industrial Engineer. Chemical Publishing Co., Inc., 148 Lafayette St., New York. 262 pages, illustrated, indexed. $4.

How to take a physical inventory quickly, easily, and accurately is told in this guide for executives who are periodically faced with the inventory problem. The fundamental principles discussed are outlined as a basis for financial reports and such data and find application in manufacturing plants, warehouses, and other places where goods are stored. The various chapters deal with the need of planning for an inventory, why a physical inventory should be taken, preparation and actual taking of the inventory, computation and verification. The final chapter discusses the analyses that may be made of the inventory and how they may be used for operating purposes.

MODERN AIR CONDITIONING, HEATING AND VENTILATING

Willis H. Carrier, Board Chairman, Carrier Corp.; Realto E. Cherne, District Chief Engineer, Carrier Corp.; Walter A. Grant, District Chief Engineer, Carrier Corp. Pitman Publishing Corp., 2 West 45th St., New York. 547 pages, charts, diagrams, illustrations, index. $4.50.

Authors' intent is to bridge the gap between theory and actual practice in the field of air conditioning, to complement texts on the physics and thermodynamics of air conditioning, and to present their material so that it will be useful to scientifically minded men and to men of limited technical training. The text is a compilation of facts, formulas, and engineering data taken from numerous sources of information used by practicing engineers and it pays special attention to the problems of application engineers. The design, application, and use of air conditioning, heating, and ventilating is explained step by step. Up-to-date revision of the psychrometric chart prepared by Dr. Carrier is included.

GENERAL ACCOUNTING

H. A. Finney, Professor of Accounting, Northwestern University. Prentise-Hall, Inc., 70 Fifth Ave., New York. 604 pages, illustrated, indexed. $5.35.

"Accounting is the language of commerce—the language in which the history of a business is recorded, its operations are summarized, its financial condition is stated, and its budget forecasts are expressed," says the author. Because so many businessmen do not adequately understand this language and are thus handicapped in their reading of accounts, interpretation of reports, service to clients, this book has been written to familiarize them with the subject. Chapters deal with such phases as accounts, the balance sheet, adjusting and closing the books,

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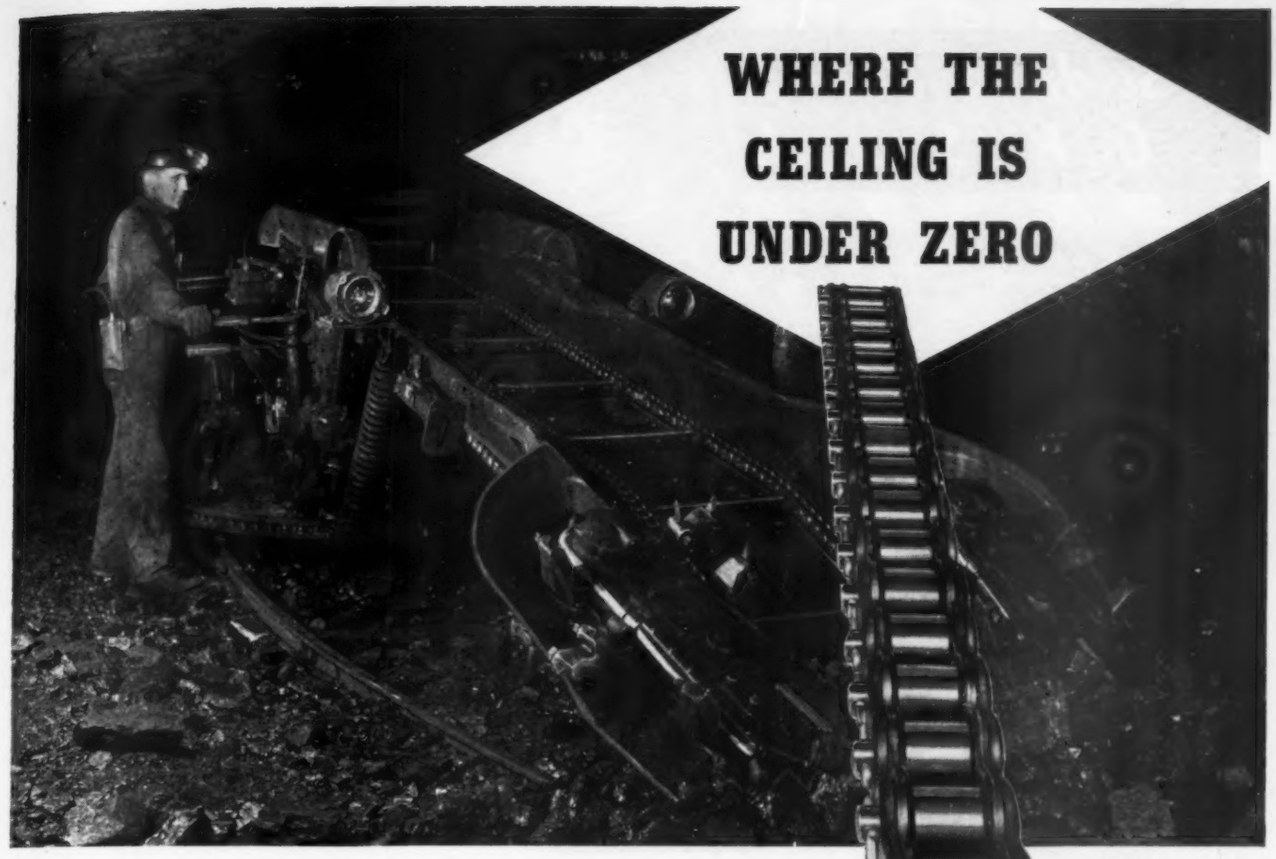

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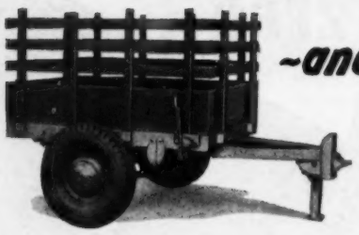

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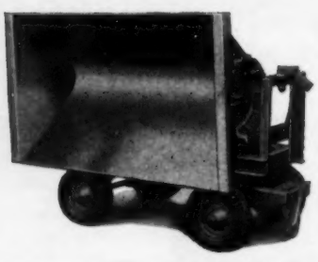

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MEN AND VOLTS

John Winthrop Hammond. J. B. Lippincott Co., East Washington Square, Philadelphia. 436 pages, illustrations, index. $2.50.

This story of the origin and first thirty-odd years of the General Electric Company relates the epic of electricity in terms of men and brings to life such great figures as Edison, Thomson, Coffin, and Steinmetz. How they and others struggled to put across electricity in its many applications; the faith, conviction, and salesmanship that went into their efforts; the success they had in making electricity the everyday implement it is constitutes fascinating reading. Photographs supplementing the text vividly picture the progress of electricity from the early arc lamps to the illumination of Niagara Falls in 1925 and the floodlighting of the General Electric Building in New York with fluorescent and mercury lights in 1940.

TECHNOLOGY AND SOCIETY

S. McKee Rosen and Laura Rosen. The Macmillan Co., 60 Fifth Ave., New York. 474 pages, illustrated, indexed. $4.

Effect of the machine on society, the relevant facts of science and technology as related to the facts of human living, are comprehensively and realistically discussed, in their economic, social and political aspects. Such questions are considered as the effect of centralization on a particular industry, the social effect of being sick in a hospital under mechanized conditions instead of at home, the political potentialities of a "radio in every home." The final chapter suggests possible ways of controlling technological influence in our lives.

•

ON THE CALENDAR

MARCH

4–5, American Society for Testing Materials, Spring Meeting, Washington, D. C. B. E. Hess, Assistant Secretary, 260 South Broad St., Philadelphia.

27–28, Tennessee Industrial Personnel Conference, Fifth Annual Meeting, Knoxville, Tenn. J. H. Williamson, Secretary-Treasurer, Tennessee Industrial Personnel Conference, Knoxville, Tenn.

24–29, American Society of Tool Engineers, Machine Tool and Progress Exhibition, Detroit. Ford R. Lamb, Executive Secretary, 2567 West Grand Blvd., Detroit.

APRIL

1–3, American Society of Mechanical Engineers, Spring Meeting, Atlanta, Ga. C. E. Davies, Secretary, 29 West 39th St., New York.

1–4, American Management Association, 11th Packaging Exposition, Chicago. Clapp & Pollak, Inc., 232 Madison Ave., New York.

22–25, Safety Convention and Exposition, 12th Annual Meeting, New York. Greater New York Safety Council, Lincoln Building, 60 East 42d St., New York.

29–May 1, Chamber of Commerce of the United States of America, Annual Meeting, Washington, D. C. Ralph Bradford, Secretary, 1615 H Street, N. W., Washington, D. C.

MAY

8–9, National Metal Trades Association, Annual Meeting, Chicago. Harry S. Flynn, Secretary, 60 East 42d St., Room 710, New York.

12, National Electrical Manufacturers Association, Hot Springs, Va. R. J. Blair, Convention Manager, 155 East 44th St., New York.

26–29, National Association of Purchasing Agents, Annual Meeting, Chicago. G. A. Renard, Secretary, 11 Park Place, New York.